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ABSTRACT

The Quality Circle project is a problem-solving concept requiring the interaction of a variety of organizational skills. Circle members work together, becoming involved in problem-solving processes. They make decisions and take action based upon the data they collect. The reliablity of those data is crucial to the circle's success. Presented in this monograph are the elements of data collection and analysis with which circle members should be familiar. These are problem identification, formulation of data collection plans, sampling, instrument selection, graphic data display, data analysis, and presentation of results. Numerous illustrated examples are provided for each element discussed. Extensive explanation of norm tables is included as well as a bibliography and appendix. (MD)

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GATHERING, ANALYZING AND PRESENTING DATA IN QUALITY CIRCLES

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June, 1982

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INTRODUCTION

This monograph is one of a series of publications prepared for the Quality Circle project in San Mateo County. Quality Circle is a problem-solving concept that requires the interplay of a variety of organizational skills:

- problem solving
- communication
- effective meetings
- time management
- decision making
- data collection/analysis
- presentations/reporting

As the Circle members become involved in the problem solving process, decisions have to be made, actions have to be taken. Decisions and actions have to be based upon reliable data and the collection of that reliable data is crucial to the success of the Circle's endeavors.

This monograph presents the various elements of data collection and analysis that Circle members will use.

- problem identification
- formulation of data collection plans
- sampling
- instrument selection
- graphic display of data
- data analysis
- presentation of results

Some of the processes described in this monograph are specific to the Quality Circle concept. Some of the processes described are commonly used in program evaluation in our schools but they, too, are applicable to the Circle's problem-solving activities.

DEFINITIONS OF DATA

As Circle members work together to solve a problem, communication is an essential part of the process. At times, understanding and communicating are dependent upon definition of a term that is erroneously considered to have a common meaning. Some basic terms used have to mean the same thing to all Circle members.

Definition of data/datum:

> data (data, data) n., pl. of datum
>
> datum (datum, datum) n., pl. data (-ta).
>
> Something given or admitted as a fact on which an inference is based.

Definition of fact:

> fact (fakt) n.
>
> A thing done; deed. That which has actual existence: an event.

> We should not expect all facts to be of the same type, or all equally accessible, or all equally easy to establish as 'factual' by a single standardized method.
>
> Some facts lend themselves to scrutiny by instruments; some can be stated in exact quantities and precise measurements; some are capable of being expressed in words and sentences; while others, no less coercive and inescapable, are almost impossible to put into language of any sort. Larrabee (1964, 101)

As problems are addressed or as programs are evaluated, three categories of data can be identified.

- product data: derived from the results of a series of of activities, e.g., reading achievement, a bread board in the shape of a pig, a water color painting.

- process data: derived from the procedures or activities implemented in order to achieve desired results, e.g., using a language master, sawing a plank, mixing water-colors.

- context data: derived from the facilities, equipment, supplies, personnel, used in the processes of education, e.g., the language master media, the maple plank, the paint pigments.

Activity Classify the following events according to the type of data that will be collected.

	Product Process Context
1. Text books arrived four months late	
2. Teacher-developed dittos were used by students rather than publishers' exercises in the teachers' edition.	
3. SAT Reading Test scores were obtained.	
4. The choir sang three selections at the graduation ceremony.	
5. The kindergarten teacher had the children use watercolors, sponges, paper.	
6. The hall bulletin board had a display of the art from the kindergarten class.	
7. Teachers met after school to plan for their inservice program.	

Activity

Some school board members after employing a new superintendent stated at an open board meeting that there had been a change in philosophy. The professional staff was disturbed and asked the board members to define "philosophy" as they used the term. In the space below write your operational definition of "philosophy.

Operational definition of philosophy:

PROBLEM AREA IDENTIFICATION

Improvement of quality can occur only after the identification and correction of the causes of a problem. Usually there are numerous factors or variables that in some interrelated way caused the problem. Those factors that are related to the problem can be set forth in an organized, visual form with the use of a cause and effect diagram.

Cause and effect diagrams can be developed for any situation.

To improve - relations between groups/individuals
- attendance
- quality of a product
- achievement of groups/individuals
- safety
- quantity produced

A cause and effect diagram allows the Circle members to concentrate on the causes of problems as solutions are sought.

Developing a cause and effect diagram is not difficult. As example of a cause and effect diagram is presented on the following page.

1. Choose the problem, process operation or characteristic to be considered

2. Represent it at the right end of the main horizontal arrow

3. List all the factors which have an influence on the operation or characteristic.

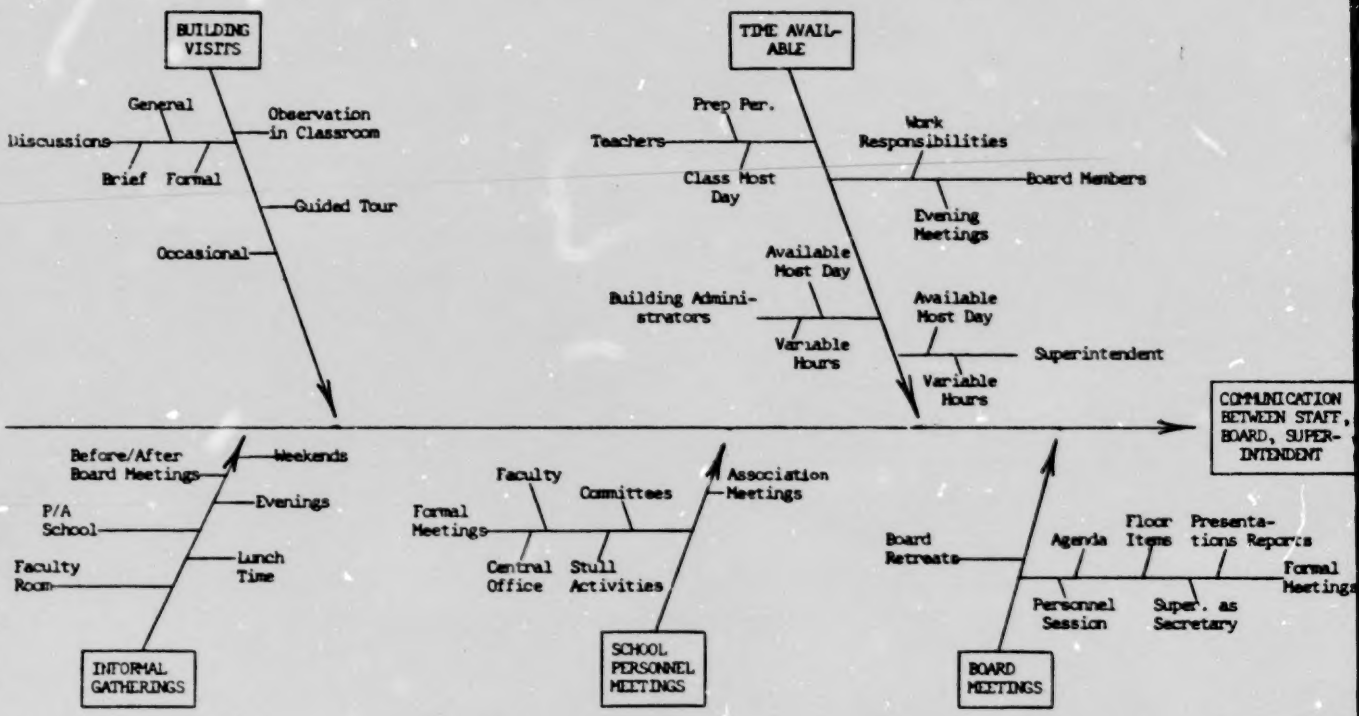
4. Arrange and stratify the factors. Select principal factors, activities, or subdivision of activities. Place boxes around the principal factors.

5. Draw the main diagonal arrows (main branches or limbs) for each of the principal factors.

6. Draw small sub-arrows (branches or twigs) for each sub-factor or sub-activity. This process of subdivision is carried out until all factors or variables are included.

7. Review and check (with QC team, etc.) if all known factors or causes or variations are included in the diagram.

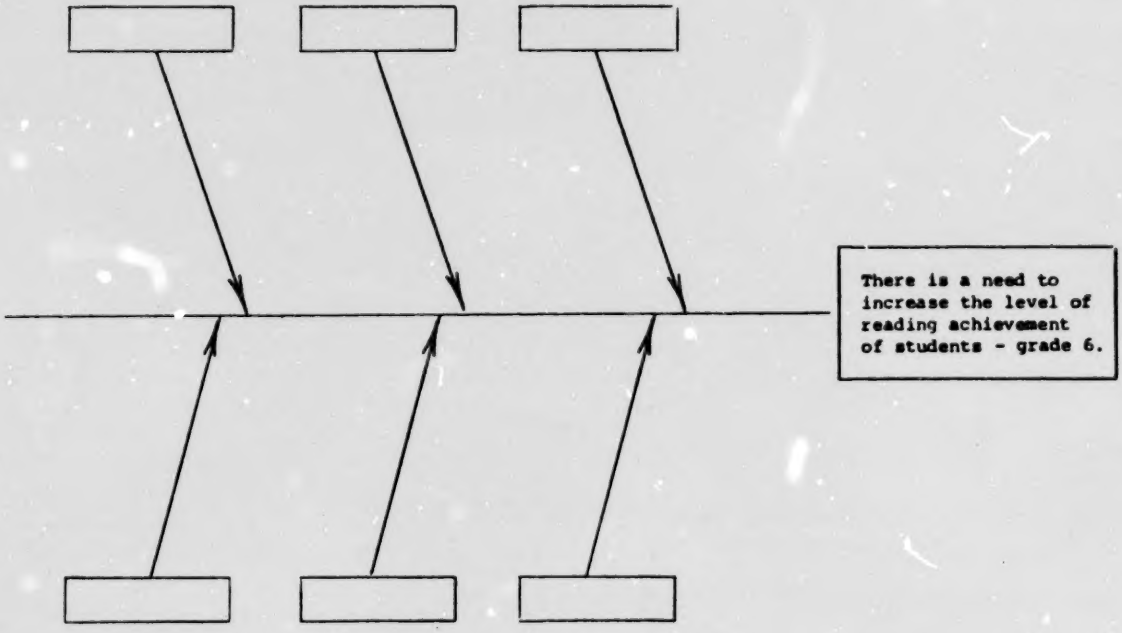
The cause and effect diagram presented below provided for the identification of the different elements related to a problem in communication that existed in one school district.



A cause and effect diagram can serve as a focus for discussions about the problem. Straying from the topic and repetitious statements can be avoided. The factors included in the diagram also serve to help identify the kinds of data that need to be collected.

In the school problem or concern areas are often identified by conducting a needs assessment. The needs assessment is a process that has as its end product a list of needs statements in priority order. Each identified need can serve as a part of a cause and effect diagram with the need statement associated with a set of causes. Data collection activities will then relate directly to those causes or principal factors.

Activity Complete the cause and effect diagram below:



A review of cause and effect diagrams allows an identification of those specific areas related to the problem for which facts should be gathered. A next step would be to determine what kinds of facts are needed and what instruments could be used to collect the required facts. However, before data are collected an overall plan is required.

DATA COLLECTION PLAN

The Quality Circle members have to be involved not only in problem identification but also in data collection. The team members have to assume responsibility for organizing the data collection plan and for assuming responsibility for collecting specified data.

The plan for the collection of data should be formally stated as a comprehensive part of the entire process before beginning any phase of the actual data collection. Certain basic considerations must be included:

- determination of exact type of data needed
- definition of the population and/or sample and instruments to be used.
- determination of the personnel who will collect the data and the scope of their responsibilities.
- distribution of appropriate information about the study to participating personnel.
- arrangements with school/program personnel for obtaining records, lists, schedules, calendars, etc.
- development of training schedules for the administration of data-collecting instruments.
- development of a timeline of all necessary data-collecting activities.
- preparation of a schedule for monitoring the data-collection process.

Monitoring the data-collection process demands special attention. If the activities are not carried out as planned or if unexpected events occur, the data needed may not be available. It should be noted that in education it is not unusual to find great differences in the implementation of the teaching processes between schools and between classrooms within a school. Documentation of the differences in data-collecting processes is necessary in order to allow proper interpretation of the data collected during the data analysis phases of the study.

Two forms can be used to help ensure that the data-collecting plan is complete and that the implementation of data-collecting activities is appropriate:

- Data Collection Timeline
- Data Collection Monitoring Form

Each should be developed before data is collected and each should be used during extensive data-collection process.

DATA COLLECTION TIMELINE

Data Collection Activity	Completion Date	Time When the Activity Will Occur — Months												Program Evaluator	Program Director	Instructional Staff	Principals	Teacher Aides	Clerical Staff	Other
		J	A	S	O	N	D	J	F	M	A	M	J							

DATA COLLECTION MONITORING FORM

Observation Date:_____ School:_____ Teacher:_____

Grade:_____ Room:_____ Date:_____ Observer:_____

PROGRAM:

Activities	Degree of Implementation			Comments
	None 0	Limited 1	Full 2	

SAMPLING

Before data collection plans are completed, some major decisions must be made.

- Should all of the students in the 8th grade be tested?
- Should the observer visit every classroom in which the new science program is being used?
- Should every parent be sent a questionnaire?
- Should every teacher in the district be included in the problem-solving discussion group?
- Should every bus be inspected each day?

Medical personnel using a very small sample of blood can diagnose a medical problem. So, too, in education samples can be used rather than investigating or assessing the total population.

The use of a sample rather than the total population has advantages.

- lower cost
- saving of time
- wider range of assessment areas
- wider variety of assessment tools
- greater depth of investigation

Population Definition

A first step in the process of using sampling as a part of an investigation or a study is to define the population. A sample is usually defined as a subset of a larger population. Before thinking about samples, therefore, a clear picture of the population is needed -- the population involved in the study should be defined.

Is the population made of:

- individuals
- classroom units
- facilities
- school buildings
- teaching techniques
- furniture
- vehicles
- stadium grass
- football players' knees

The specific purpose of the study is the element that must be considered as the population is defined.

Random Sample

Sampling procedures used should ensure that the sample selected is representative of the total population. Random sampling is the technique usually suggested in order to obtain the representative sample. Many methods are commonly used as educators endeavor to choose a random sample.

- take every tenth name on the class list
- use the first ten students that arrive
- draw ten names out of a hat
- ask teachers for the names of ten students
- pick ten students from the parents names on the PTA list

However, the most effective method involves use of a table of random numbers.

Activity

Use the table of random numbers on the following page and select three sets of five students from the class list below. With 20 students on the class list, two digits in each five-digit number on the table of random numbers will be used.

1. Paul Addison
2. John Aguirre
3. Phyllis Buros
4. Jean Byrne
5. Jesus Gonzales
6. Yoko Kato
7. Alice Kim
8. John Lavelle
9. Julio Mendez
10. Ramon Mendosa
11. Jorge Munez
12. Tom Oliver
13. Sherri Otter
14. Andy Pope
15. Carmen Rodriguez
16. Terri Rudolph
17. Roy Russell
18. Roger Sanders
19. Barbara Saunders
20. Rodney Smith

	Horizontal Left Upper	Vertical Left Upper	Vertical Right Bottom
1.	_____	_____	_____
2.	_____	_____	_____
3.	_____	_____	_____
4.	_____	_____	_____
5.	_____	_____	_____

Row No.	TABLE OF RANDOM NUMBERS (DIGITS)									
1	50691	91653	88574	08675	12700	32027	41034	56912	34264	77[illegible]9
2	19787	66937	91769	13399	96096	43165	72096	86350	23062	99419
3	16746	77983	10861	23664	64557	78213	43857	68009	20483	00618
4	91039	16099	38824	00778	23058	76539	50584	71810	52589	32778
5	11075	62081	88977	78676	53855	56472	13090	01708	89016	45111
6	41230	92934	30342	29533	24597	72632	21727	63861	80454	47243
7	59028	24399	05075	64775	59803	45737	19025	46696	18914	03062
8	42957	25204	00753	60284	85483	34984	86637	95354	80698	98750
9	45881	59475	64445	98261	55252	50788	31295	16437	49497	22493
10	75104	45819	88471	75440	55309	63481	23615	64950	73291	10964
11	78614	07347	63528	84643	10455	95596	38158	75758	65628	10498
12	69278	59274	67459	53563	98241	18097	65297	49803	99145	25320
13	58626	91259	13832	75095	08333	53845	74223	82690	89320	89565
14	81630	00339	07996	65249	66792	05555	79169	12136	44621	95904
15	74330	13688	02044	65910	96007	82692	40473	56437	35671	95072
16	70829	66963	86390	26458	02385	41505	06239	68990	32915	89542
17	55084	58581	60759	20627	86682	76542	03648	38183	29823	68134
18	98845	17428	97397	62400	51284	92211	40593	82713	06067	46190
19	48116	91870	16346	97406	54649	42039	58407	84248	45780	60547
20	82778	31709	71564	26258	07522	03825	92087	21809	25678	39987
21	86615	67618	07446	63129	07111	70516	67289	09457	48995	08043
22	82558	99260	69136	35099	68187	85382	09569	94211	57824	98100
23	08290	70291	74090	96503	56140	27794	27765	51740	07712	29816
24	95062	76310	81603	86828	68370	46001	79205	35[illegible]11	91239	52961
25	30361	66712	86801	29556	91232	98295	87322	99172	50009	27224
26	17390	96107	70391	78715	61943	33315	39778	97149	08122	86388
27	05390	33046	63920	28733	42644	38972	98161	79861	88282	28279
28	06624	21114	33869	20940	03732	39973	89948	81060	36381	06027
29	38146	77295	33742	00135	26587	54775	94846	18587	39327	71711
30	76430	28645	62335	60393	71813	52677	09917	89100	93855	75617
31	16664	30164	22546	63538	79376	26865	61995	60418	37777	84170
32	56424	64680	81038	79364	23815	44002	38380	09864	35950	10760
33	95954	15540	18554	63349	70259	03212	91950	16214	80378	56421
34	59007	56364	49965	61970	32493	55404	85950	99606	46328	17887
35	19341	87208	99853	40202	08553	78731	83463	19524	82512	13556
36	24505	87007	35748	54865	40209	49466	94574	31406	64422	87185
37	15086	92183	84632	36790	59608	00371	67456	55361	80669	75402
38	65664	02188	09164	70939	25856	24344	58859	10454	19212	59078
39	40397	76835	14062	96067	70645	23695	59140	75812	18804	55529
40	31700	24753	22919	43207	83387	27820	12494	30041	88927	22668
41	14472	19372	23759	47116	81647	44946	97716	41157	30913	30842
42	18018	57089	98428	89075	77511	15194	69634	68269	52292	63404
43	16752	54266	76103	05268	41145	36100	73916	32462	01658	68565
44	47184	33660	96555	56656	18238	56888	29315	99813	47831	81395
45	93884	63945	06606	45545	29237	21040	43552	02749	19963	23705

Stratified Random Sample

In many cases a simple random sampling procedure, by chance, will not result in a representative sample: for example, the sample may have a disproportionate number of girls. In order to control factors that may interfere with the selection of a truly representative sample, a stratified sampling procedure should be used.

Total 6th Grade	Stratified Sample
200 students Girls - 60 or 30% Boys - 140 or 70%	40 students Girls - 12 or 30% Boys - 28 or 70%

Sample Size

The table presented below shows sample sizes for a range of population sizes. The table was developed to provide a degree of accuracy of 90%, that is, results derived from the sample would be within 5 percentage points of what the results would have been had the entire population been used.

N	S	N	S	N	S
5	5	220	140	1200	291
10	10	230	144	1300	297
15	14	240	148	1400	302
20	19	250	152	1500	306
25	24	260	155	1600	310
30	28	270	159	1700	313
35	32	280	162	1800	317
40	36	290	165	1900	320
45	40	300	169	2000	322
50	44	320	175	2200	327
55	48	340	181	2400	331
60	52	360	186	2600	335
65	56	380	191	2800	338
70	59	384	192	3000	341
75	63	400	196	3500	346
80	66	420	201	4000	351
85	70	440	205	4500	354
90	73	460	210	5000	357
95	76	480	214	6000	361
100	80	500	217	7000	364
110	86	550	226	8000	367
120	92	600	234	9000	368
130	97	650	242	10000	370
140	103	700	248	15000	375
150	108	750	254	20000	377
160	113	800	260	30000	379
170	118	850	265	40000	380
180	123	900	269	50000	381
190	127	950	274	75000	382
200	132	1000	278	100000	382
210	136	1100	285	1000000	384

At times sampling is not practical because of the relatively small size of the population and the relatively large sample size needed. However, small samples for pilot studies or studies of an exploratory nature can be used to provide indications that can be explored in detail later with larger groups. Small sample groups of 20 to 50 can be selected but, even with the small exploratory-type study, the sample should be somewhat representative of the population from which it was selected.

Activity

Indicate the numbers you would select for a sample of 50 numbers of the faculties from a school district's seven high schools. The study is a preliminary stage in the preparation of a questionnaire for a school climate investigation.

Seven High Schools Total Faculties N = 1007		Sample Size N = 50
Position	Number	Number
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
Totals	1007	50

INSTRUMENTS

After the type of data to be collected has been identified and after the sampling decisions have been made, the methods of data collecting have to be established.

Appropriate instruments have to be found or developed in order to provide facts that are considered accurate and reliable. The term "instrument" is broadly defined:

- published achievement test
- teacher-made unit test
- needs assessment survey
- questionnaire
- checklist
- observation form
- log
- attendance roster
- grades
- diary
- vehicle repair invoice
- purchase order

The purpose of the instrument is to allow for the orderly and systematic accumulation of facts that must be gathered if the study/investigation is to progress.

It should be noted that, after the preparation of a cause and effect diagram, a problem may be solved after a discussion of the problem and identified factors by Circle members. In such cases no instruments may be required, and no formal data collecting process needed.

If the need for instruments is demonstrated, the selection of assessment instruments begins with a general question:

What is being measured?

- Achievement
- Performance
- Attitudes
- Interactions among persons
- Size/number of objectives

What kinds of instruments will be used?

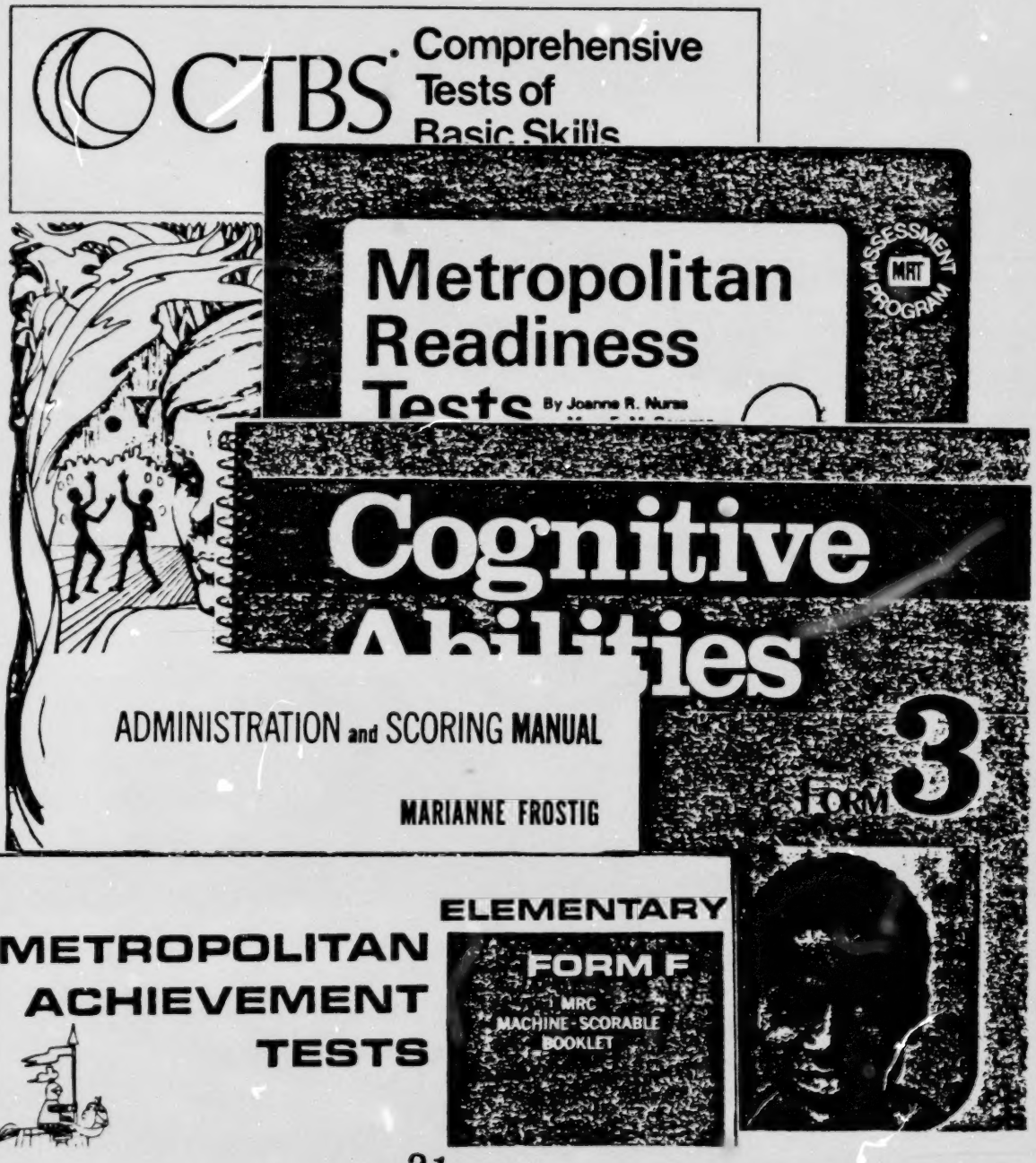
- Achievement tests
- Questionnaires
- Observational records/checklist
- Logs (pupil/teacher/school records)

A variety of sources is available in which instruments are named, described and/or evaluated.

- Buros' The Eighth Mental Measurements Yearbook
- Buros' Tests in Print II
- Center for Study of Evaluation at University of California at Los Angeles (Hoepfner)
- Test Publishers' Catalogs and Technical Manuals
- Tests and Measurements in Child Development (Johnson and Bommarito)
- Socioemotional Measures for Preschool and Kindergarten Children (Walker)
- Measures of Social Psychological Attitudes (Robinson and Shaver)
- Mirrors for Behavior (Simon and Boyer)
- EPIE Institute
- ERIC Clearinghouse on Tests, Measurement, and Evaluation (Educational Testing Service)
- ETS Test Collection
- Test publisher catalogs
- Professional journals:
  Educational and Psychological Measurement
  Journal of Educational Measurement
  Journal of Counseling Psychology
  Personnel and Guidance Journal
  School Psychologist
  Journal of Learning Disabilities
  Measurement and Evaluation in Guidance
  Applied Psychological Measurement

Norm-Referenced Standardized Tests

Educators, dealing with student outcomes, traditionally employ norm-referenced standardized tests as sources of data. Raw scores, percentile ranks, grade equivalents, stanines, scaled scores -- all are accepted as "facts" and those facts are numbers that "everyone understands." Reputable test publishers and scoring services can indeed provide facts that are considered accurate and usable. However, it should be stressed that the appropriate use of the instruments is entirely the responsibility of the users.



What kinds of scores are there?

- Raw Score: Number of right responses obtained by an individual

Advantages	Disadvantages
Easily obtained by counting right answers, appropriate for use with inferential statistical tests.	Must be changed to some type of derived score in order to make comparisons with a norm group.

- Grade Equivalent: A score derived from a raw score that expresses grade level as an average (e.g., 8.2 is the achievement level expected of the average student in the second month of the eighth grade)

Advantages	Disadvantages
Reasonably sound "inherent" meaning in lower grades. Uses familiar units.	Easily confused with standards. By definition, half the group it was developed on are above the average. Difficult to compare results of different tests. Not meaningful at upper grade levels.

- Percentile: The score below which a given percent of the cases lie

Advantages	Disadvantages
Widely used and easily understood. Probably best all-around type of score especially when sued with percentile bands that account for the probable error of measurement.	Units along scale not equal in size. Differences near median are over-emphasized. Raw score differences between 90th and 99th percentile are much greater than raw score differences between 50th and 59th percentile

- Standard Score: A scaled score based on the mean and standard deviation which define the distribution of scores

Advantages	Disadvantages
Has equal units through entire range of values. Has normal distribution by design. Appropriate for use with inferential statistical test	Not commonly used in local school settings except in large-scale national testing programs such as those provided by Educational Testing Service and the American College Testing Program. Difficult for most people to understand.

- Stanine: A scaled score with a mean of 5 and a standard deviation of 2

Advantages	Disadvantages
Gives maximum information for a 9-unit scale. Resonably easy to understand. Minimizes non-significant differences as do percentile bands.	A single unit of change is very large and so will not reflect small differences in achievement. Not widely used.

- Categories: In open-ended questionnaire results key ideas are categorized so that if there is a wide difference between the number of statements categorized and the number of persons responding, one may wish to look back to find out if a few persons are being so verbal as to bias the results.

- Rankings: In objective questionnaire results a series of options can be arranged in rank order according to personal preference.

- Rating Scales: Assign numerical values to the various responses to an item in order to spread them. That is, a rating scale gives the rater rater the opportunity to present his or her opinion on a continuum of judgment. Most rating scales permit the rater a choice of three to five values.

Norms Tables

Standardized tests usually provide a series of norms tables which are used to interpret the meaning of a student's test scores. Norms are derived from a representative sample of students used by the test publisher: The average score or typical performance for a specified group. The norm and/or median are the same. The norms tables permit the converting of raw scores to grade equivalents, standard scores, percentile ranks, and stanines, and the converting of scale scores to grade equivalents. An example of a norms table is presented on the following page.

An example of a conversion from raw score to a grade equivalent score is presented below.

> The table on the following page is used to convert raw scores to grade equivalent scores. The body of the table is composed of raw scores in columns, headed by the designations for tests, skills area totals, and the total battery. In the outer columns, on either side of the table, are listed the Grade Equivalents (G.E.) corresponding to raw scores.
>
> To obtain a Grade Equivalent for a student with a raw score of 35 for his Total Reading score, find the raw score of 35 in the Total Reading column. Follow across the row of raw scores to the G.E. column at the outer edge. The Grade Equivalent for that student on that skills area appears where the raw score row and the Grade Equivalent column intersect. Therefore, a student obtaining a raw score of 35 for the Total Reading score has a Grade Equivalent of 8.2 for that skills area total.

RAW SCORE TO GRADE EQUIVALENT

Level 4

GE	Raw Scores: Reading Vocab	Reading Compr	Reading Total	Language Spell	Language Mech	Language Expr	Language Total	Mathematics Compu	Mathematics Cncpt	Mathematics Appli	Mathematics Total	Total Battery
7.7			33									105
7.8					12		45				30	106-107
7.9										7		108
8.0		21	34					15				109
8.1						18	46				31	110
8.2	14		35									111-112
8.3				16			47					113
8.4		22	36						9		32	114-115
8.5						19	48					116-117
8.6			37					16				118
8.7	15										33	119-120
8.8		23	38				49					121-122
8.9										8	34	123
9.0					13			17	10			124-125
9.1			39	17			50				35	126
9.2	16	24				20						127-128
9.3							51				36	129
9.4			40					18			37	130-131
9.5									11			132-133
9.6			41					19			38	134-135
9.7	17	25	42			21	52					136-137
9.8				18			53			9	39	138-140
9.9			43						12		40	141-142
10.0		26			14	22	54	20			41	143-144
10.1	18		44				55				42	145-146
10.2		27	45				56	21			43	147-148
10.3				19					13		44	149-150
10.4	19		46			23	57				45	151-153
10.5		28	47					22			46	154-156
10.6	20		48				58			10	47	157-158
10.7							59	23	14		48	159-161
10.8		29	49			24					49	162-163
10.9	21		50	20	15			24			50	164-165
11.0							60				51	166-167
11.1		30	51								52	168-169
11.2	22		52				61	25	15		53	170-171
11.3						25						172
11.4	23		53				62	26		11	54	173-174
11.5		31	54					27				175
11.6				21								176-177
11.7	24		55				63	28			55	178
11.8			56			26					56	179
11.9		32									57-58	180-181
12.0	25		57		16				16		59	182
12.1							64	29			60	183
12.2			58								61	184
12.3		33	59							12		
12.4	26						65	30			62	185
12.5			60	22		27						186
12.6								31			63	187
12.7	27		61									
12.8											64	
12.9		34						32				
13.0							66				65	188
13.1			62									
13.2	28											
13.3								33				
13.4			63									
13.6											66	
13.9	29-40	35-45	64-85	23-30	17-20	28-35	67-85	34-48	17-25	13-25	67-98	189-268

Observation Forms

Observational checklists or logs can be used to record data about a wide variety of behaviors.

- participation in group/individual activities or meetings
- assumption of responsibilities
- interactions
- use of material or equipment
- completion of a product
- implementation of an activity or event

Depending on the problem area or area of investigation, many different types of instruments may be needed. If behaviors are to be recorded after observation sessions, forms must be developed. Observation forms are usually developed specifically for the unique event to be measured -- although forms developed for a particular study can often be adapted for local use.

Advantages and Disadvantages of Observation

Advantages	Disadvantages
1. Can provide valid and reliable information on social-emotional personal adjustment not possible with other traditional methods	1. Difficult to get valid and reliable data
2. Can test a person's ability to apply information in life-like situations	2. Long period of training and experience may be required for the observer
3. Easily adapted to a variety of tasks, settings, and individuals at all educational levels	3. Many activities take place simultaneously in a classroom and it can be difficult to record behaviors that are significant
4. Provides a valuable supplement to achievement data	4. Interpretation of observational findings must take into account the content, must not generalize from a too-limited sampling of behaviors, must not give disproportionate weight to negative incidents, and must be as objective as possible, given the data at hand
5. Can provide both qualitative and quantitative data	5. Behavior in such structured settings as a room full of toys, creativity box, or micro-teaching, may be too laboratory-like for generalizing to behaviors in other situations
6. Observation of behavior in artificially created settings can yield information on rarely occurring or otherwise difficult-to-assess behaviors.	

The "numbers" collected as observational data depend upon the event observed and, at the same time, the measure accepted as appropriate for that specific event. As an example, time on task is often of concern and the data collected are usually collected and reported as minutes.

Pupil: Mary Smith					
			MINUTES ON TASK		
Date	Reading	Math	Language	Total Time on Task	Total Avail. Time
Jan. 1	20	20	15	55	110
Jan. 2	18	20	12	50	120
Jan. 3	22	18	25	65	100
Jan. 4	25	22	37	84	120

Questionnaires:

One of the most extensively used instruments in schools is the questionnaire. Some questionnaires are sent to parents and request a response to one item.

> "Are you available to supervise a field trip to City Hall on February 17 at 8:30 a.m. to 11:30 a.m.?"

Some questionnaires request responses to dozens of items and are several pages in length.

Questionnaires are used as an economical way to collect information from a wide audience. The data collected can be voluminous and, therefore, considerable thought and planning should be devoted to the development of the instrument. The type of data wanted determines the type of items written.

Open-ended and objective items are the two types of items commonly used in a questionnaire. Each type of item has its advantages and disadvantages.

Open-ended Items:	Advantages	Disadvantages
	- Easy to prepare - Allows for free expression - Can get reasons for responses - Don't have to know total possible range of responses - Motivates those who enjoy writing - Provides source of verbatim comments for reports	- Difficult to score and compile - Can misinterpret responses - Asking respondents to invest more time - Ability to write clearly may inhibit respondents - Emphasis is on subjective information

Example: List the most valuable and least valuable aspects of the inservice workshop.

Most valuable:_____

_____

Least valuable:_____

_____

Objective Items:	Advantages	Disadvantages
	- Easy to score and compile - Consistency in interpretation of responses - Requires a minimum of the respondent's time - Provides a mass of data for a specific area	- Respondents have no opportunity to "argue" - Respondents have limited number of options - Don't get reason for responses - Respondents can complete the form without "thinking"

Example: How important was the inservice for the implementation of the new reading program?

Very Important	Moderately Important	Somewhat Important	Not Important
_____	_____	_____	_____

ANALYSIS OF DATA COLLECTED

In Quality Circles in Education four levels of data analysis can be identified:

- logical interpretation of discussions or actions taken
- review of a minimal quantity of descriptive numerical data
- review of an extensive set of descriptive numerical data
- review of inferential statistical analysis of data

Logical Interpretation:

Following the identification of a problem and the preparation of a cause and effect diagram, Circle members may employ a data analysis that revolves around the specific actions and decisions of a particular role group. As an example, recall the cause and effect diagram presented earlier in this monograph that dealt with a problem in communication: the cause and effect diagram represented a situation in a school district in which various role groups expressed discontent and uneasiness with the actions of the superintendent and board. Results of interaction between representatives of the role groups uncovered some basic misunderstandings and unstated negative feelings related to the following:

- different definitions for commonly used terms
- involvement in decisions is not always apparent
- mistaken assumptions that "hidden" verbal messages were interpreted as intended
- power and decision-making are legitimate forces in the exercise of responsibilities

Through discussion the various role groups came to a common understanding and decided upon new actions that would tend to reduce the communication barrier. Thus, data analysis by those participating in the problem-solving process was essentially a "give-and-take" open discussion in which motives and actions were discussed, and no numerical data were included in the process.

Minimal Descriptive Data

Numbers can be compiled and used to describe a situation:

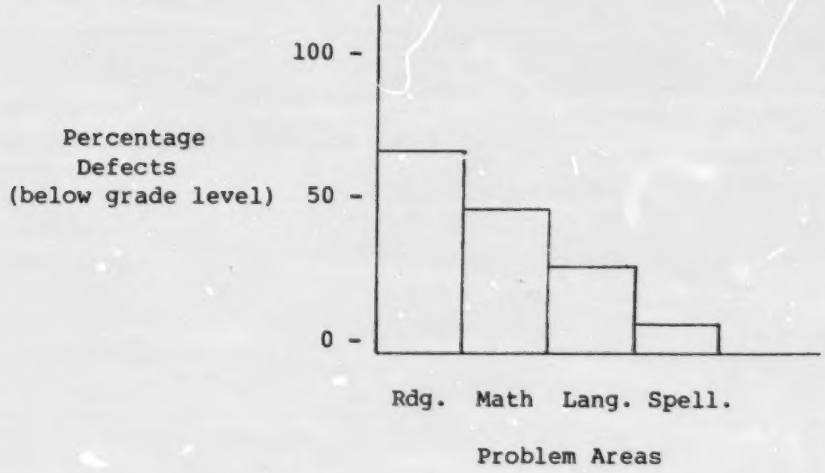
- How many students are below grade level?

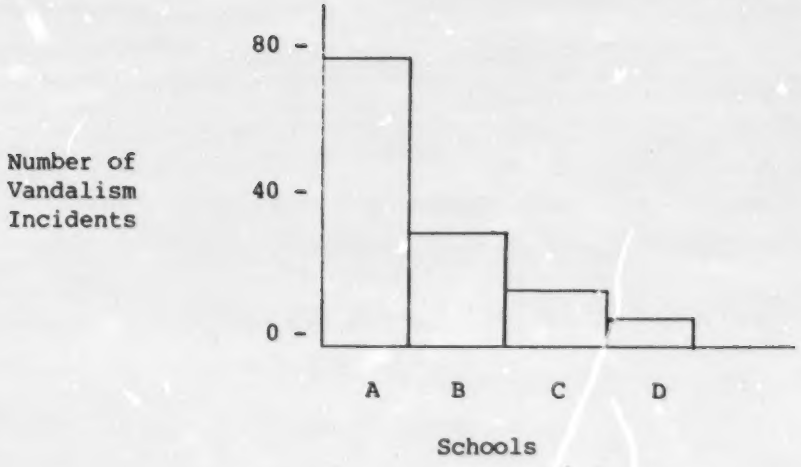
- How many incidents of vandalism occurred?

- How many bus breakdowns were there last month?

After the preparation of a cause and effect diagram, the Circle members may decide that only a limited quantity of data is needed. The review and analysis of the data collected can be enhanced by use of Pareto diagrams.

A Pareto diagram is a visual display that can be used to identify the relative magnitude of problem areas. The diagram is a bar graph that presents the "tallest" bar first, followed by "shorter" bars in descending order. The tallest bar represents the most significant problem area.

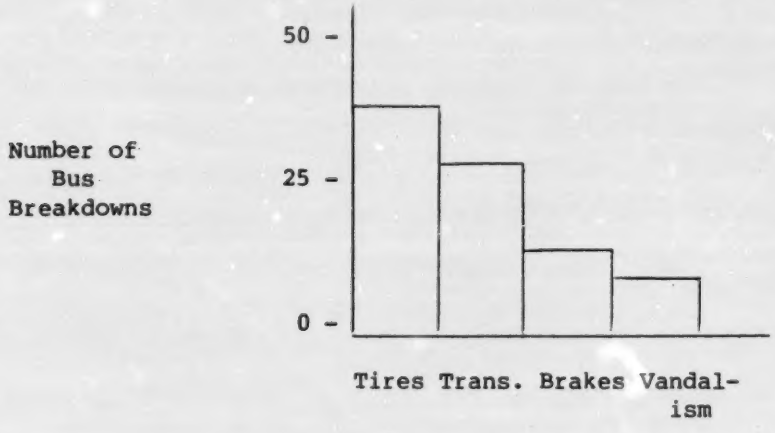




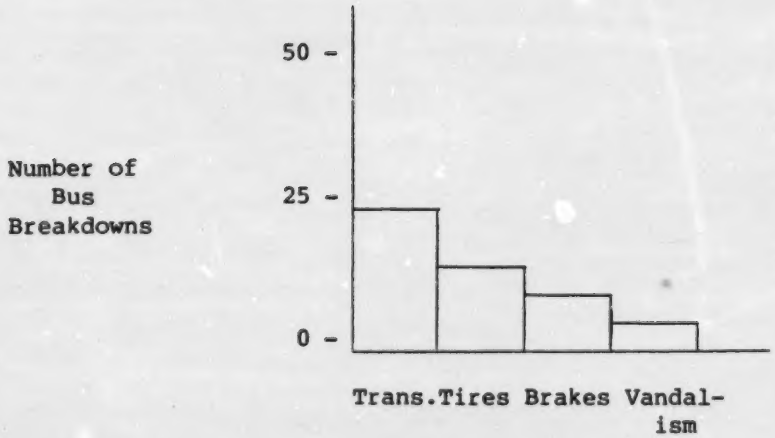
The vertical axis represents the number or percentage of "defectives." The horizontal axis represents the problem areas in the study. In attempts to eliminate problem areas, it is easier to reduce the tallest bar by one-half than to reduce a short bar to zero.

After the preparation of the Pareto diagrams, the Circle members must identify solutions and specify needed actions. That part of the process involves discussion and, in all probability, additional data gathering efforts. Repeated data collection and repeated preparation of Pareto diagrams follow the implementation of activities. However, if the data to be collected are minimal in quantity, the analysis process is essentially a review of the new diagrams and discussions related to new actions.

"Before" and "after" Pareto diagrams can be used to visualize change after attempting to reduce or eliminate a problem condition.



Before



After

"After" Pareto diagrams usually show a position shift: the tallest bar is reduced and its placement moves to the right -- another problem area usually then becomes "tallest."

Extensive Descriptive Data

The cause and effect diagram may indicate that the investigation or study will involve relatively large sets of data. If so, numerous preparatory steps are necessary before to the actual analysis of the data collected. In addition, some basic statistical concepts have to be understood because decisions in the way the data are to be treated and displayed have to be made.

Statistical Concepts:

Descriptive statistics are those that are used to describe a group or a set of scores. Here the mean, median, mode, range and standard deviation are of importance. The description of a set of scores is a necessary part of a statistical study and/or report and often serves as the only treatment of the data.

Central tendency:

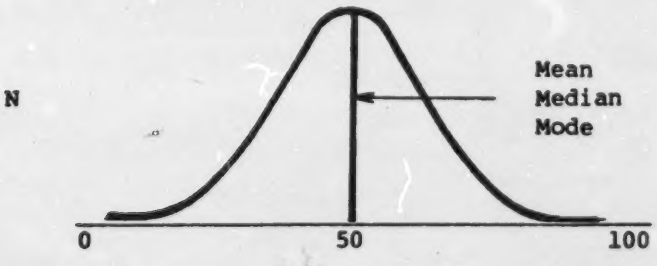
Three measures of central tendency can be used to describe the "typical" individual or measure in a group: mean, median, and mode.

The mean is the arithmetic average. It is affected by extreme scores, but tends to fluctuate less from sample to sample than the other two measure of central tendency. The mean is derived when more computational work is anticipated.

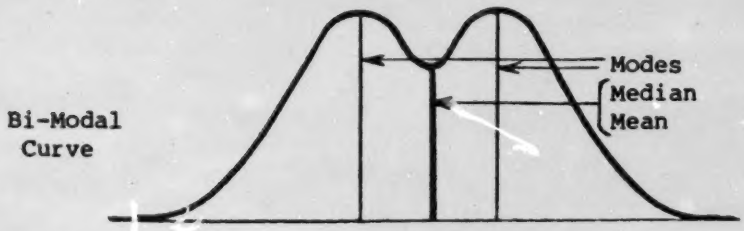
The median is the midpoint in a distribution -- half of the cases are above, half are below. The median is especially useful when a few extreme scores are contained in the frequency distribution. Because it is a "counting" average, it is not influenced by the size of deviant scores.

The mode is the measure or score which occurs most often. It is the easiest to obtain and provides the measure which is the most typical case.

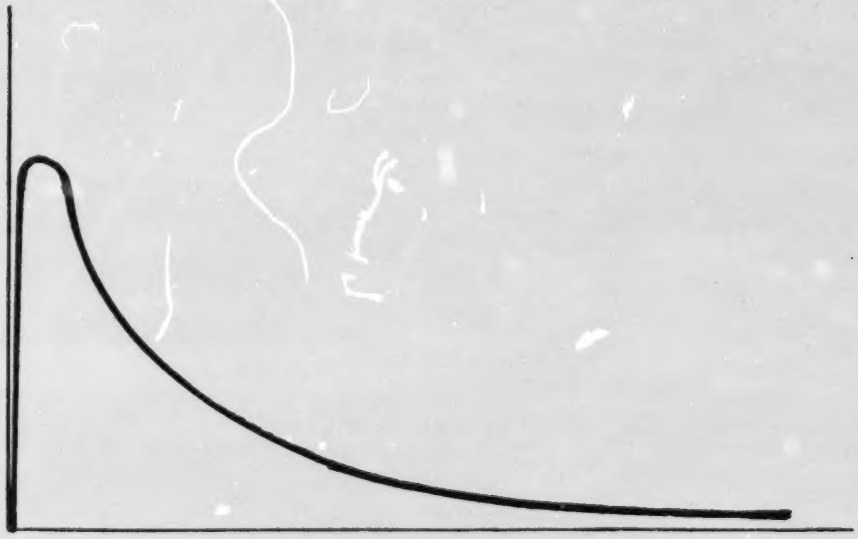
A distribution which is symmetrical is called a normal distribution. Mode, median and mean are all identical in a normal distribution.



A curve can be multi-modal -- can have two or more peaks, as follows:



Extremely skewed and bi-modal distributions should not be described with a single measure of central tendency, because no one measure, such as the mean, can even approach representing a true picture of a typical score.



With a small number of respondents a frequency distribution with an interval of one can be used to determine and indicate the mean, median and mode.

Frequency Distribution

Instrument Title: Stanford Achievement Test - Arith. Comp.

Date Administered: 5-75 **Type of Score:** Raw Score **Group:** Remedial

X	Tallies	f	cf
36	I	1	42
35	II	2	41
34	II	2	39
33	III	3	37
32	IIII	5	34
31	IIII I	6	29
30	IIII	4	23
29	IIII	4	19
28	III	3	15
27	III	3	12
26	II	2	9
25	II	2	7
24		0	5
23	II	2	5
22		0	3
21	II	2	3
20		0	1
19	I	1	1

Mode = 31.0

Median = 30.0

Mean = 29.3

N = 42

Derivation of the Median

1. Develop a frequency distribution of the scores.

X	Tallies	f	cf
34-36	////	4	29
31-33	//// //	7	25
28-30	///	3	18
25-27	////	5	15 ←
22-24	//	2	10
19-21	//	2	8
16-18	/	1	6
13-15	//	2	5
10-12	/	1	3
7- 9	//	2	2
		N=29	

2. The median is the $\frac{N}{2}$ or $\frac{29}{2}$ point in the distribution.

   The $\frac{29}{2}$ or 14.5 point is found in the 25-27 interval.

3. Beyond the 10 in the 22-24 interval, 4.5 cases are needed -- 4.5 of the 5 in the 25-27 interval.

4. Median = Lower Limit + Ratio Needed x Size of Interval

$$= 24.5 + \left(\frac{4.5}{5} \times 3\right)$$

Perform operation in parentheses first -- then add.

$$= 24.5 + \frac{13.5}{5}$$

$$= 24.5 + 2.7$$

$$= 27.2$$

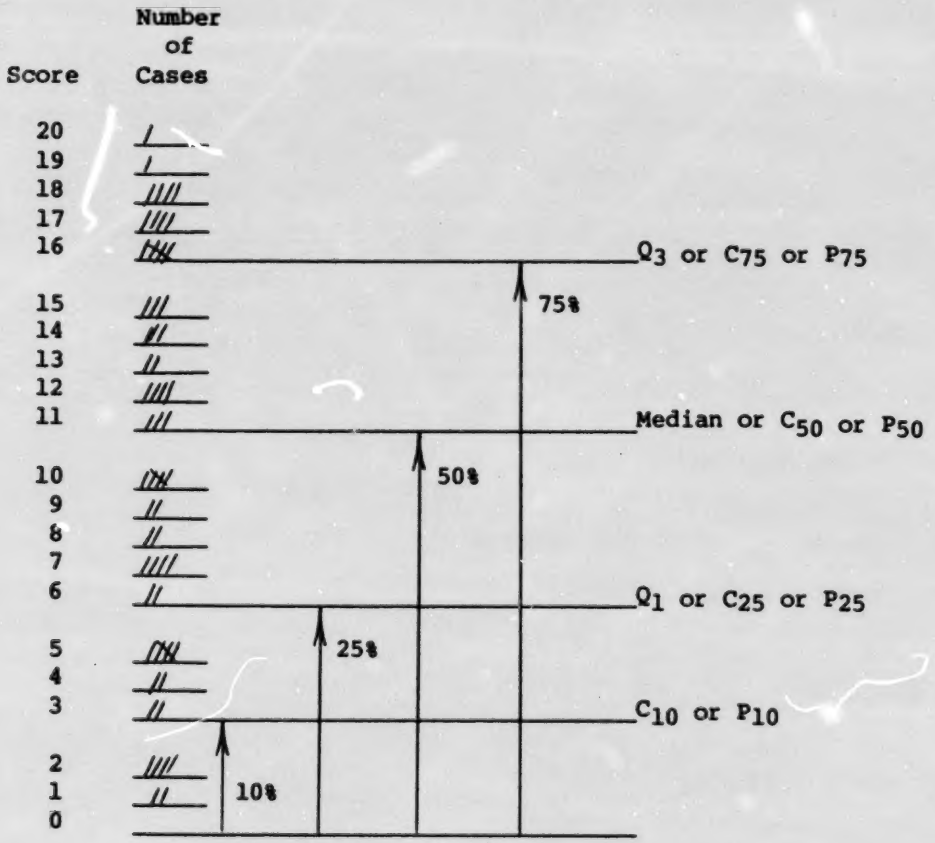
Quartiles:

When the median is used to describe a distribution, Q_1 and Q_3 are often included as descriptors.

Q_1 - the first quartile or the 25th percentile; the point in the distribution below which 25% of the cases are found

Q_3 - the third quartile or the 75th percentile; the point in the distribution below which 75% of the cases are found.

Quartiles are special cases of a more general descriptor. A centile (percentile) is a point in a distribution which has a given percentage of the cases below it. For example, the 10th centile (C_{10}) or 10% of the cases below it.



Derivation of the mean:

With a small number of scores the simplest way to calculate the mean is to add all the scores and divide by the number of cases; however, small hand calculators often have the mean as a built-in function and that, then, eliminates the necessity for the mathematics and the use of the process shown on the next page.

Number of Cases = 15

	Raw Score
	18
	12
	22
	8
	10
	9
	11
	14
	6
	17
	21
	21
	18
	13
	12
TOTAL	212

$$\text{MEAN} = \frac{212}{15}$$

$$= 14.1$$

Derivation of the Mean Using an Arbitrary Origin

1. Develop a frequency distribution of the scores.

X	Tallies	f	x'	f'
34-36	////	4	9	36
31-33	//// //	7	8	56
28-30	///	3	7	21
25-27	////	5	6	30
22-24	//	2	5	10
19-21	//	2	4	8
16-81	/	1	3	3
13-15	//	2	2	4
10-12	/	1	1	1
7- 9	//	2	0	0
		N=29		Efx' 169

2. Select an Arbitrary Origin (AO) in column x' and assign it the value "0." If the bottom interval is the Arbitrary Origin (AO), negative numbers are avoided. The Arbitrary Origin (AO) is the mid-point of an interval (e.g., with the 7-9 interval, 8 is actually the AO.)

3. Complete column x' by numbering up to the top interval.

4. For each interval multiply across the f times the x' to produce column fx'.

5. Add column f and fx'.

6. Substitute in the formula:

$$\text{Mean} = \text{Arbitrary Origin} + \left(\begin{matrix}\text{Size of} \\ \text{Interval}\end{matrix} \times \frac{\text{Sum of fx'}}{\text{Number of cases}}\right)$$

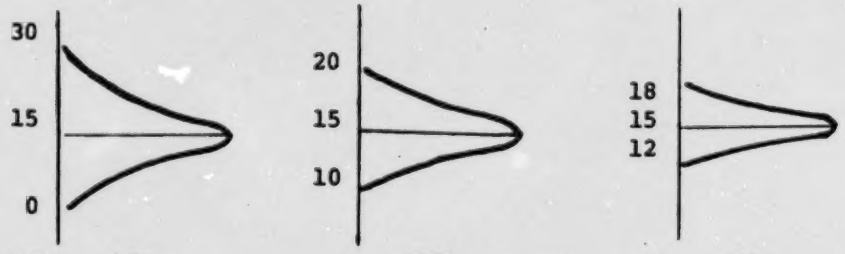
$$= AO + \left(i \frac{E\,fx'}{N}\right)$$

$$= 8 + \left(3 \times \frac{169}{29}\right)$$

$$= 25.5$$

Spread of scores:

In order to describe a distribution in some detail, a measure of the spread of scores is necessary. For this purpose the range can be used.

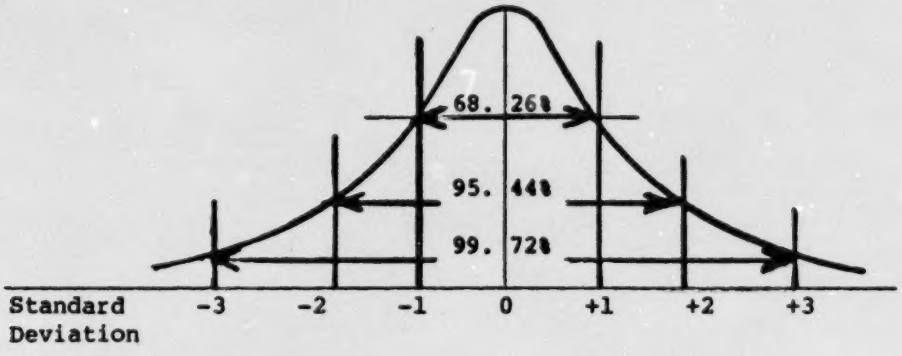


Mean: 15
Range: 0-30

15
10-20

15
12-18

However, the standard deviation is commonly used to indicate dispersion. The standard deviation is a measure of the spread of scores around the mean.

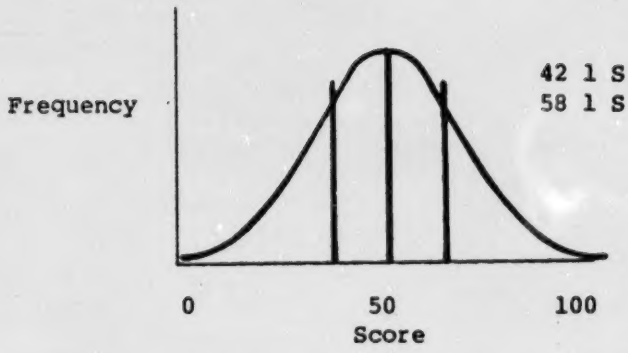


The distance from 1 standard devitation below the mean to 1 standard deviation above the mean includes about 68% of the scores in the distribution.

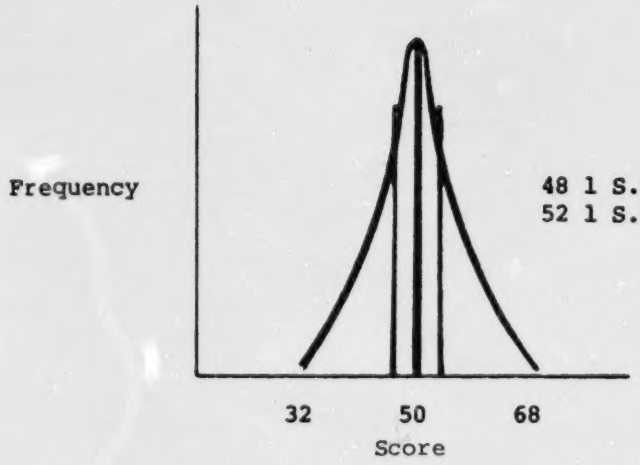
The distance from 2 standard deviations below the mean to 2 standard deviations above the mean includes about 95% of the scores in the distribution.

The distance from 3 standard deviations below the mean to 3 standard deviations above the mean includes about 99% of the scores in the distribution.

Distributions may have the same mean, but may be decidedly different. The standard deviation provides an indication of differences. The two distributions shown on the next page both have a mean of 50, but the standard deviation of one is 8 and the other is 2. The different standard deviation reflect the differences in range or the "bunching" of scores.



Between the scores 42 and 48, 68% of the "students" are found



Between the scores 48 and 52, 68% of the "students" are found.

A method of calculating the standard deviation is not too difficult. However, many inexpensive hand calculators include the standard deviation as a built-in function -- eliminating the need for the mathematics.

Data Analysis - Score Data

The first steps in the analysis of large data sets are purely clerical. But as simple as these steps may seem, they are necessary. Scores must be recorded in a manner that makes them readily accessible for mathematical treatment at a later time.

Scores are not always test scores. They may be numbers present at parent meetings, observations of student behaviors, ratings of equipment provided by administrators, or ranks showing student position on statewide tests. The term score has a broad connotation.

Organizing the data:

A form for recording scores is a must. Scores from tests, other measurement instruments, or observations are usually recorded in columns using an alphabetical listing of examinees or respondents. Raw scores, "the number correct," are recorded and, if any other types of scores are desired, converted at a later time in another form.

A written list of scores is of importance:

- as a permanent record of the scores
- as a source of data for the mathematical treatment of the data
- as a part of a report

As an example, a copy of an actual grade six list is presented on the next page. The numbers are raw scores for a reading diagnostic test which was administered to pupils in a middle school lab.

Bayside Reading Project - Raw Scores

Name of Pupil	Sound Discrimination Pre	Sound Discrimination Post	Blending Pre	Blending Post	Rate Pre	Rate Post
Peter	13	11	2	10	14	37
Dionicio		28	27	29	11	25
Alison	28	34	12	32	4	25
Bill		32		26		25
Tammy M.						
Belinda	25	24	27	33	17	25
Donally A.	25	28	17	31	15	23
Mike	26	27	17	20	14	27
Brenda	33	33	35	35	11	35
Patricia A.	22	21	7	9	8	12
Johnny		19		25		14
Sean	17	9	2	7		37
Sabina	33	30	26	30	14	31
Lesa	29	32	30	33	14	20
Frank	22	29	16	19	11	18
Cathy	18	33	26	31	11	28
Barry	25	28	12	13	8	18
Thomasena	29	27	20	22	17	22
Eugene	30	33	18	25	13	26
Jeanne	34	35	31	35	37	37
Lori	33		29		11	
Sherri	26	33	14	27	11	14
Delisa	15	23		14		16
Lorraine	34	33	27	34	19	20
Danny	23	16	11	26	37	37
Gaye	23	25	15	24	13	37
David	27	29	17	31	15	22
Mike	34	32	30	36	12	37
Bernie		19		28		24
Randy		24		16		17
Diana	16	30	10	31	11	26

Stanford Diagnostic Reading Test Level II, Form W
Administered - Pretest: 10-7-75
Posttest: 5-17-76

Frequency distributions:

A next step is to develop a freqency distribution from the initial list. Data is organized in columns with scores listed in one column and the number of individuals that obtained a particular score tallied in a second column. The number of the score tallies is placed in the "f" or frequency column.

Two types of distributions can be developed -- grouped and ungrouped.

In the following example with ungrouped data the class interval is 1.

	X (Score)	Tallies	f
	26	/	1
	25	///	3
Class Interval	24	/// /	6
of 1	23	///	5
	22	//	2
	21		0
	20	/	1
			N=18

In the following example with grouped data the class interval is 5. (e.g., 5-9 includes 5, 6, 7, 8, 9)

	X (Score)	Tallies	f
	55-59	/	1
	50-54		0
Class Interval	45-49	///	3
of 5	40-44	///	5
	35-39	/// //	7
	30-34	////	4
	25-29	///	3
	20-24	//	2
	15-19	///	3
	10-14	/	1
	5- 9	/	1
			N=30

Grouped freqency distributions are used when the score range is fairly large.

For grouped data some common practices --

- between 10 and 20 intervals; too few intervals constrict the distribution and too many produce gaps

- an odd number for the size of the interval; but for convenience, at times, multiples of 10 are used

- start at the "bottom" with an interval that includes the lowest score and "work up" to an interval that includes the highest score.

Cumulative frequency:

Included as a part of a frequency distribution, the cumulative frequency (cf) column is used for the calculation of some descriptive statistics. The cumulative frequency column is obtained by adding the frequency column from the bottom and recoding subtotals in each space as you move up the cf column.

X	Tallies	f	cf
26	/	1	18
25	///	3	17
24	//// /	6	24
23	////	5	8
22	//	2	3
21		0	1
20	/	1	1
		N=18	

The cumulative frequency column is particulary useful in the computation of the median, Q_1 and Q_3.

Frequency distribution forms:

The next two pages present the two types of distributions, ungrouped and grouped, on a form prepared specifically for the purpose of developing a frequency distribution.

Frequency Distribution

Instrument Title: CTBS - Reading

Date Administered: 5-75 **Type of Score:** Lowest **Group:** Remedial

X	Tallies	f	cf
36	II	2	33
35	I	1	31
34	II	2	30
33	III	3	28
32		0	25
31	IIII	4	25
30	IIII I	6	21
29	IIII	5	15
28		0	10
27	III	3	10
26	II	2	7
25	I	1	5
24		0	4
23	II	2	4
22		0	2
21	I	1	2
20		0	1
19	I	1	1

Frequency Distribution

Instrument Title: CTBS - Reading

Date Administered: 5-75 Type of Score: Raw Score Group: Remedial

X	Tallies	f	cf
35-37	III	3	40
32-34	IIII	5	37
29-31	IIII IIII III	13	32
26-28	IIII	5	19
23-25	III	3	14
20-22	I	1	11
17-19	III	3	10
14-16	II	2	7
11-13	II	2	5
5-10	I	1	3
5-7	II	2	2

Choice of Statistics:

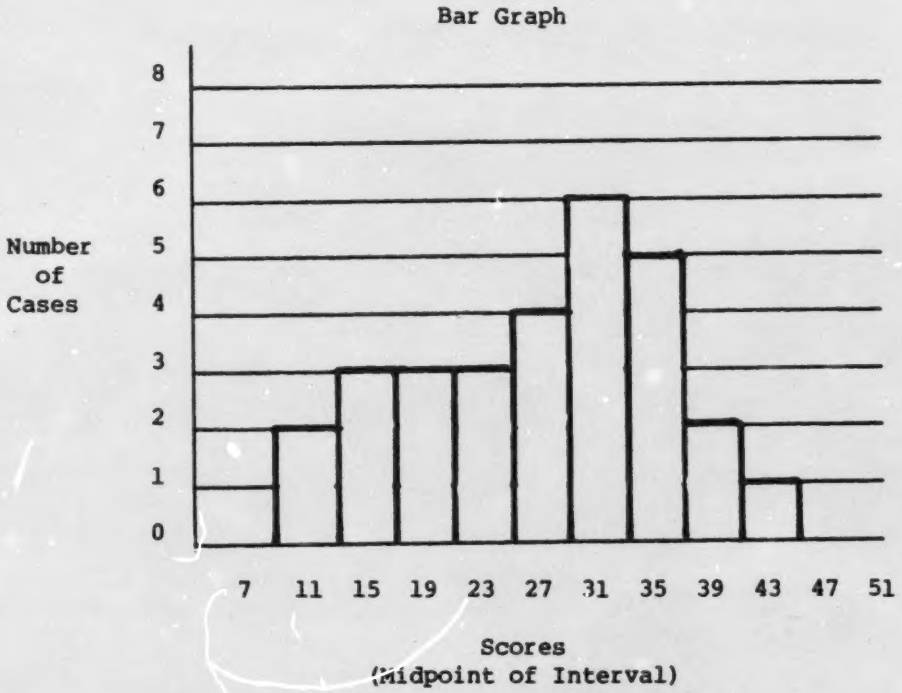
The specific statistics used in the analysis depends upon the specific situation or problem but in every case some choice has to be made. Is the mean or median to be used? Is the standard deviation of importance?

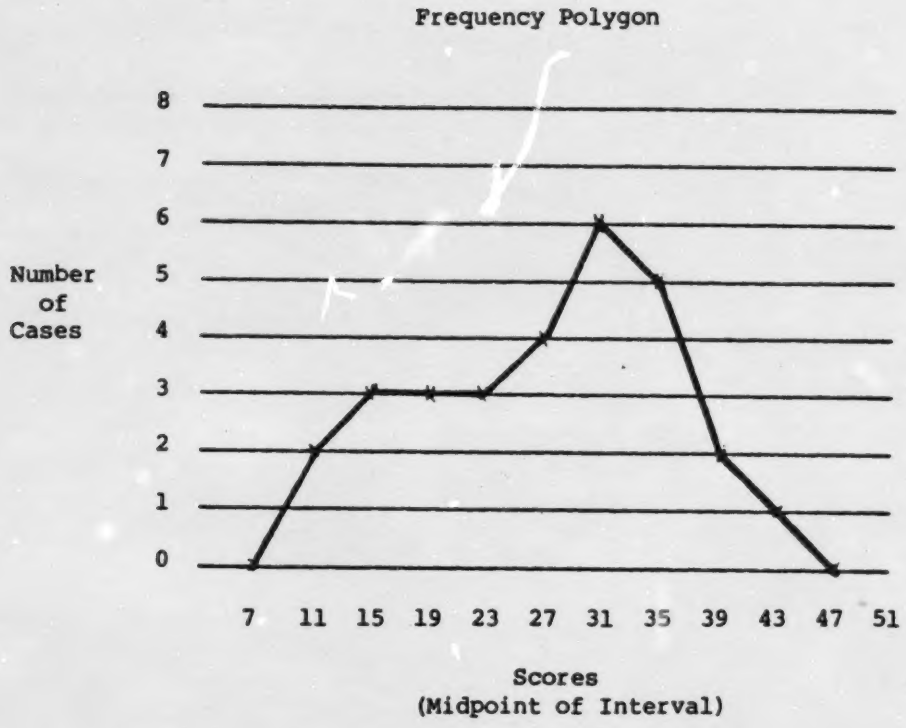
Are the statistics to be provided for the entire group or for two or three sub-groups?

Along with the description of the distribution and the numerical values, some written discussion about the numbers of students or "cases" at particular points in the distribution might be necessary to help make the information clear and meaningful.

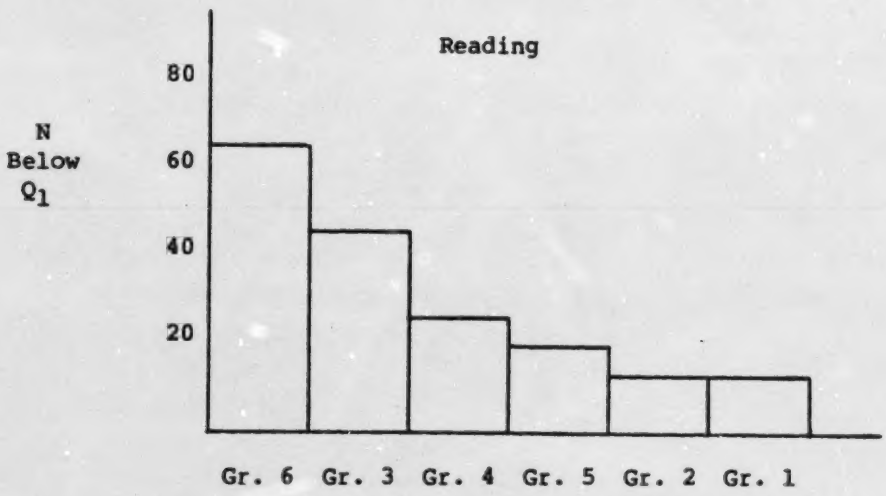
Visual Displays:

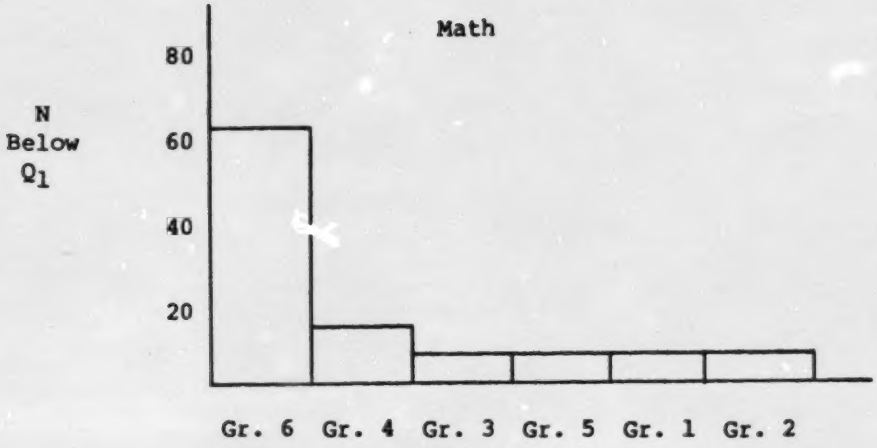
The analysis can benefit from a visual display of the data and it is here that a frequency polygon or bar graph can be used for clarity, to highlight the problem areas.





From the mass of data, Pareto diagrams can be prepared to identify particular elements that require the Circle members' attention. The data for the diagrams are obtained from the frequency distributions that were systematically prepared during the initial data analysis activities.





The Pareto diagrams, as described earlier, serve as the focus for discussions that lead to problem-solution activities.

Data Analysis - Questionnaire Responses

Questionnaires are so widely used that special attention should be directed toward the use of questionnaire results. Generally, only descriptive statistics are used in the analysis of questionnaire results.

In order to develop conclusions from questionnaire responses, the responses must be summarized in a form that allows for easy and logical review. The process includes tabulation and summarization.

Open-ended items and objective items require different approaches.

Open Ended Items:

- Type all responses to each item verbatim in a summary list.
- Develop a list of headings under which responses can be grouped -- ten to twelve would be a manageable number.
- Place each response under an appropriate heading.
- Add additional headings for responses which cannot be classified readily.
- Review the headings in order to combine any that overlap.
- If applicable, rate each response as positive, neutral, or negative.
- Prepare a table summarizing the data prepared, using number (N) and percent (%).

- Review results in the table and prepare evaluation comments and conclusions.

One format that could be used to prepare for an analysis of the responses is presented below. There is no one correct format or procedure and the Circle will devise its own. The data summarized in the example were derived from a questionnaire which solicited parent reactions to an open education program in a K-5 school.

Example:

Questionnaire Item: What is your feeling about the Open Education Learning Program at Hall School?

Total number of respondents: 51
Total number of comments: 60
Total number of positive comments: 38
Total number of neutral comments: 2
Total number of negative comments: 20

Category Heading	N	%	Positive N	Positive %	Neutral N	Neutral %	Negative N	Negative %
1. Learning environment	7	12	4	7	1	2	2	3
2. Progress in school subjects	9	15	5	8	1	2	3	5
3. Attitude toward school	8	13	8	13				
4. Independence of students	8	13	6	10			2	3
5. Motivation toward class work	3	5	3	5				
6. Classroom control - discipline	6	10					6	10
7. Supervision	4	7					4	7
8. Concept of self/ others	4	7	4	7				
9. Program of instruction	8	13	8	13				
10. Work habits	3	5					3	5

Writing evaluation comments and conclusions can be an activity for a small group -- a sub-committee of the Circle or of a school site council.

The comments and conclusions are logical extensions of the summarized data and are the "personal interpretations" of the data as written by the person or group preparing the analysis.

The data from the Open Education Learning Program questionnaire allow for statements and conclusions.

Example:

> Ten comments regarding classroom control and teacher supervision are negative. Some parents are concerned and a review of the comments indicates that supervision and discipline are perceived as too lax.
>
> Parents also view parts of the program as successful. Student attitude toward school, motivation, and the program of instruction are viewed positively.

Objective items:

Is a computer available? With the use of data processing equipment the compilation and data reduction should be the routine implementation of procedures established prior to the administration of the questionnaire, and the questionnaire developer should work closely with data processing personnel to design the format of the instrument. Also, arrangements for the processing of the questionnaires, as they are received, must be planned and a time schedule developed.

The questionnaire could be designed so that a key-punch or terminal operator could read the data directly from the returned questionnaire. Otherwise, a coding sheet can be used and the responses transferred to it from the returned questionnaire. One labor-saving technique is to use a response form that can be "read" by a scanner with the data automatically transferred to disc or tape storage.

If the responses to objective-type items are to be processed by hand, they are usually tallied on a blank questionnaire or on a specially prepared form that corresponds to the questionnaire items. Several steps -- all clerical tasks -- are involved in the compilation and are shown by example on the next page.

Example: Tallies are recorded -- one by one

I. School Building:	VERY GOOD	AVERAGE	POOR	NO COMMENT
Classroom Facility	𝍸 |	𝍸 𝍸 𝍸	𝍸 𝍸 ||	𝍸 |
Class Size	𝍸 |	𝍸 𝍸 𝍸 𝍸		
Educational Program	𝍸	𝍸 𝍸 𝍸		
Colleague Assistance	𝍸 |||	𝍸 𝍸 𝍸 ||	||	
Teacher Aides (Quantity)	||	𝍸 𝍸	𝍸 𝍸	
Parent Involvement in School Activities		𝍸 |||	𝍸 𝍸 𝍸	

For each item the tallies are then turned into numbers and percentages. The base number, the divisor, for caluculating the percentages is the total number of responses to that item. Each item is treated separately unless several items are to be combined and discussed as a group.

Example: Numbers are recorded -- percentages are calculated

I. School Building:	VERY GOOD		AVERAGE		POOR		NO COMMENT	
	N	%	N	%	N	%	N	%
Classroom Facility	3	9	15	45	8	24	7	21
Class Size	3	9	30	91	0	0	0	0
Educational Program	10	31	23	70	0	0	0	0
Colleague Assistance	8	24	23	70	2	6	0	0
Teacher Aides (Quantity)	3	9	15	45	15	45	0	0
Parent Involvement in School Activities	0	0	8	24	25	76	0	0

In the analysis of objective-type items, one commonly used approach is to collapse the responses and consider "yes" vs. "no" or "agree" vs. "disagree." The numbers and percentages from the tallying shown on the previous page would be organized under new headings.

Example:

	Agree-ment		Disagree-ment		Lack Information to Judge	
	N	%	N	%	N	%
1. There are adequate facilities for the physical education program.	12	28	36	60	7	12

However, reviews of the extremes are necessary, for they may reveal some very strong feelings that should be noted and included in the discussion.

	Strongly Agree		Agree		Dis-Agree		Strongly Disagree		Lack Info to Judge	
	N	%	N	%	N	%	N	%	N	%
1. There are adequate facilities for the physical education program.	2	3	15	25	8	13	28	47	7	12

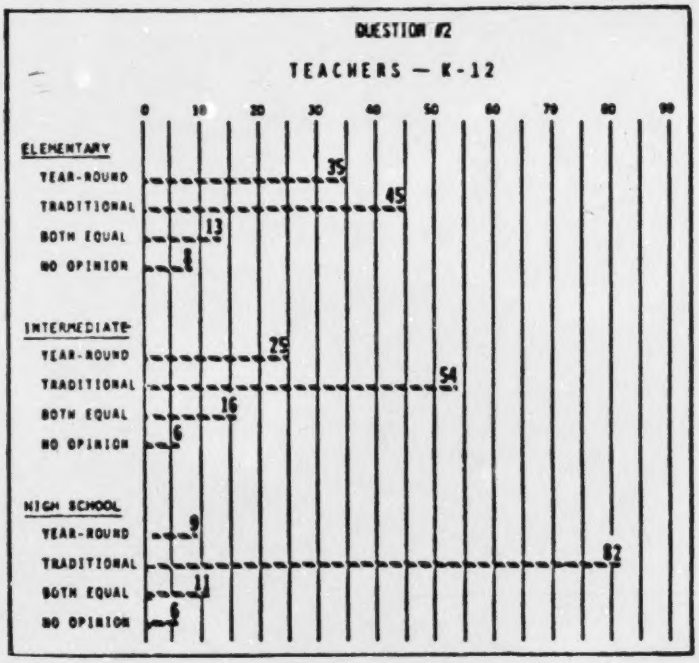
Evaluation statements and conclusions -- as with open-ended items -- are logical extensions of the summarized data. They are the "personal interpretations" of the data as perceived by the reviewer.

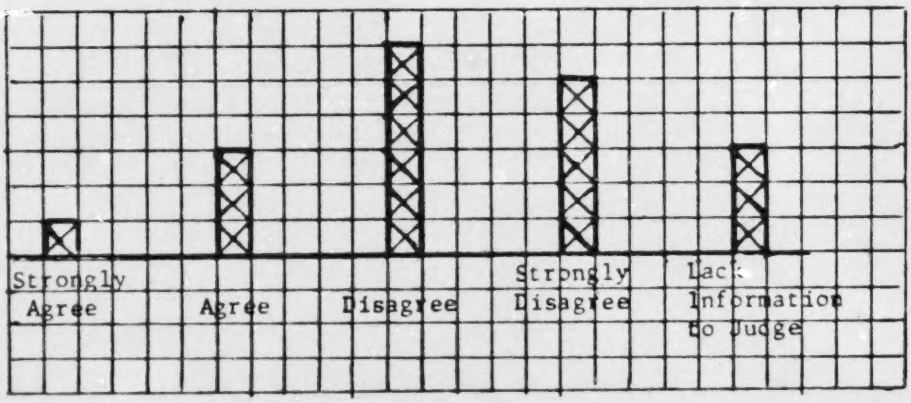
It is to be noted that analyses can be "item by item" or by items grouped together. The added step of aggregating or combining the response tallies before a group analysis would result in statements and conclusions concerning a wider topic -- perhaps the entire area about which a set of questionnaire items were written.

Visual displays:

At times, displays help make the data more meaningful and, as with score data, bar graphs and polygons can be prepared.

Examples:





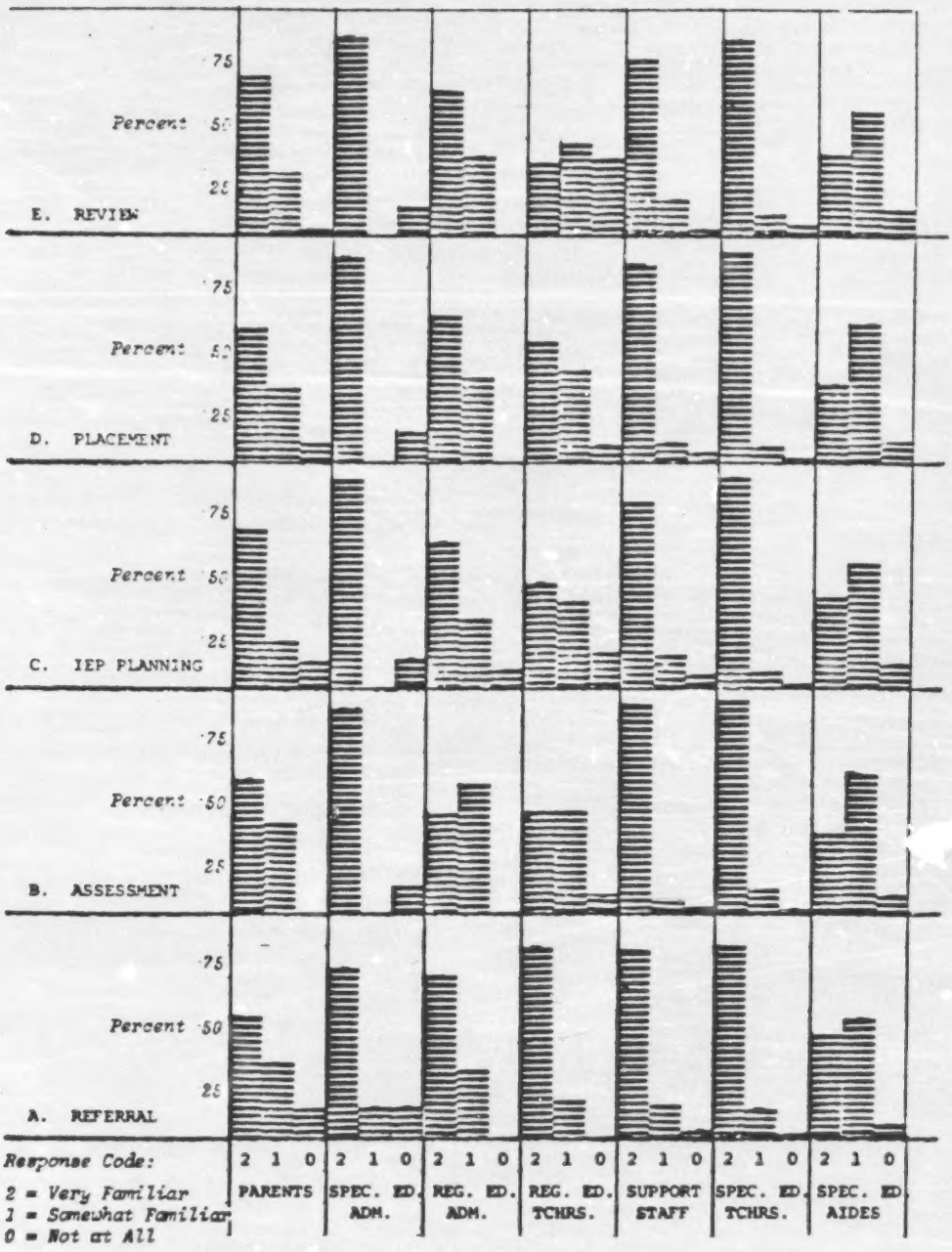
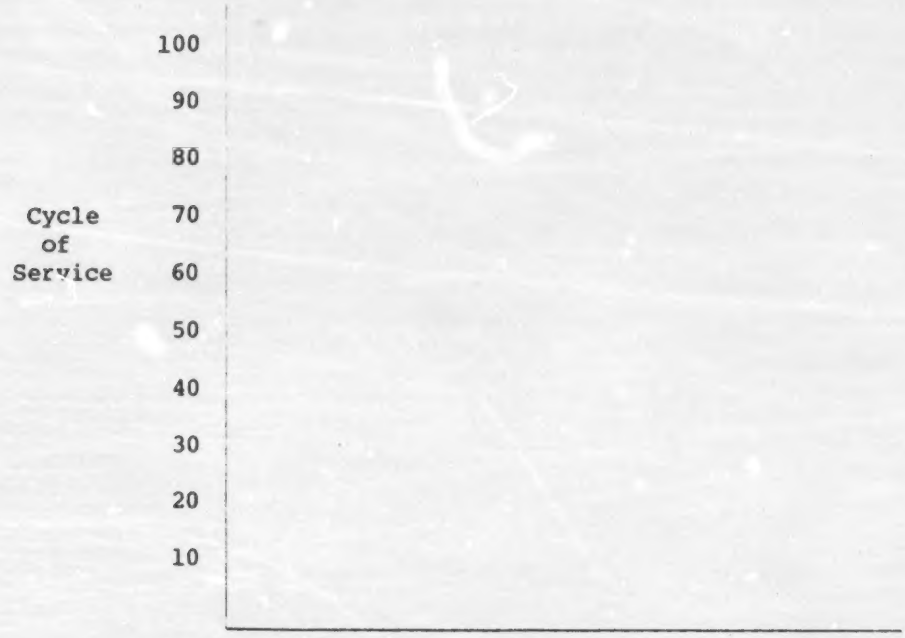


Figure 1. Summary of Percentage of Responses to Special Education Survey Item 1. Five services, termed "the cycle of services," are provided for students in special education. How familiar are you with these services?

Pareto diagrams can also be prepared.

Activity

Prepare a Pareto diagram using the data presented in the bar graph series, Summary of Percentage of Responses to Special Education Survey. Communication was identified as a problem area for the review process and "not at all" used as an indicator of the magnitude of the problem for each of the role groups.



The Pareto diagrams, as described earlier, serve as the focus for discussions that lead to problem-solution activities.

Inferential Data Analysis

Inferential statistics are used in order to determine if the data collected are related to chance fluctuations or are due to the effects of a program or activity. However, because of their technical nature, inferential statistics are not included as a part of this monograph.

If the rigorous treatment of data is necessary and if none of the Circle members are knowledgable about the techniques, a qualified person should be found to perform the analyses.

Final steps with inferential data analysis would be similar to those discussed earlier for the other three levels of data analysis:

- a review of the statistics generated
- preparation of Pareto diagrams
- identification of solution strategies
- implementation of solution strategies
- additional data collection/analysis following implementation of solution strategies

REPORTING

Problem Question

The first step in report planning is to list the problem questions that need to be answered in the report. Questions may pertain to student progress toward program objectives, to the relative effectiveness of different programs. to achievement status compared to norm groups, to program implementation, and to staff/administration communication. Stating the questions at the outset allows for a systematic approach to presenting information.

Audience

The audience will dictate the language of the report and the most effective displays of the results. Details of the report can vary according to the needs of the audience. Does the group set goals or policies? Does it decide levels of financial support? Does it plan the instructional program? Consider the characteristics of the audience that affect the reporting strategy. What are their responsibilities, interactions with other audiences, time contraints, interests, accessibility, questions to which they want answers? Compare the knowledge of the audience with the content of the message you want to deliver, and then determine what prerequisite information that person or group needs to understand the message. The extent of information appropriate to decision-makers may differ from the extent and type of information needed to communicate with the public.

The following is a sample list of audiences:

- Parents need to know how the program is functioning as a whole, if their own contributions have been successful, how their children are performing, how problems are being resolved.

- Teachers need ideas on the quality of instructional decisions they are making about students. They need to feel that the program is being evaluated or monitored in an appropriate way. They need to know if the parts of the program that are outside their influence are carried out as planned. They need an idea of the overall progress of the students in the program, as well as how teachers are involved in problem solving strategies.

- Principals,or others responsible for supervising instruction, need data related to the question, are programmatic and instructional goals and objectives being met? Since they have the sensitive job of monitoring school activities, they need a clear description of how the processes are functioning.

- Curriculum specialists have the major responsibility of evaluating data regarding the adequacy of the current curriculum. They need answers to such questions as: 1) are our goals and objectives correct, and 2) are our materials and methods appropriate to meeting those goals and objectives? Assuming that

teachers and instructional supervisors are doing an adequate job, data are needed to compare performance due to different materials, approaches or settings.

- The superintendent needs data that will make it easier to work with the school board in making basic funding and staffing decisions or to approve specific instructional or curriculum decisons. The data should be clear, concise and uncomplicated; complex details can delay decision-making. Along with a copy of the final report, the superintendent would find useful a basic presentation that would include brief abstracts or overviews, graphs and diagrams, and multiple lines of evidence leading to a series of conclusive statements.

- The school board should receive basically the same reports as the superintendent, along with an explanation of how they fit with board policy or recommendations. Graphs and diagrams are essential. As with the superintendent, they are interested in the bottom line: do we need more funds, more staff or reorganization, and why? Since most school board meetings are open to the public, the data should be presented by someone who can sensitively answer questions from the citizens of the community.

- The PTA and/or Parent Advisory Committees act as vehicles establishing communication between parents and the school. They will want to know how well the program is doing; what its areas of strength and weakness are and what will be done to maintain the areas of strength, and improve the areas of weakness? Presentation of data to this audience might involve graphic displays to address the first question, and conclusion statements and recommendations for the latter questions.

- The news media report the data and then editorialize to a lesser or greater degree. There are two important things we want the news media to reflect: 1) an accurate, but easy-to-understand, display, and 2) interpretations that are possible within the limitations of the data. Devising carefully written press releases, including an honest discussion of what the data mean and do not mean, plus a general discussion of confidence in the data, will help. It is important that the press release should not come before the information is given to the school board and PTA -- they should not be the last to know.

Need or Purpose for Report

Consider the needs of the audience in planning the report. What decisions does each audience make, and what information is needed for those decisions? If the purpose of the report is simply to share information, be sure that the questions of interest to each audience are addressed.

General Report Format

The Quality Circle report is essentially a description of the identification and analysis of the problem considered by Circle members. The report also contains a presentation of alternative solutions to the problem and specific recommendations for the solution or solutions deemed most promising. One general report format is presented below.

- Statement of the problem identified by the Circle members
- Conditions or activities associated with the problem - includes cause and effect diagrams
- Discussions and actions of Circle members
- Data collected - includes tables and graphic displays
- Unanticipated findings
- Problem solution alternatives
- Recommendations
- Suggested plan for follow-up

The format presented above is only one of many that might be used as a Quality Circle report. Generally the report should be a clear description of the actions and deliberations of the Circle members.

GRAPHIC DESIGN CONSIDERATIONS

There are many factors that could be considered important ingredients in designing visuals that communicate effectively.

The purpose of this section is to consider a few design considerations that can make understanding and remembering the data easier. The six considerations that follow are not rules. They are simply guidelines to help with the design of effective visuals. The visuals discussed are largely variations of graphs.

To focus on each design consideration, the graphs have been simplified by omitting unnecessary information, e.g., titles and headings that would be required if hard data were presented.

In examining the six design considerations, remember that graphs may be improved and communication enhanced by combining these various design considerations. The possible ways to combine design elements seem endless. However, when this is accomplished, remember to keep the audience and the purpose in mind. Each visual should be designed to communicate a specific message. When various design elements are combined in a single visual, strive to keep it simple.

Simplicity:

The most critical design consideration is simplicity. A graph or visual should communicate clearly, and therefore the message must be free from noise. Like radio interference, too much visual information garbles any message. Clutter confuses, keep graphics simple.

Legibility:

If it can't be read, it can't be understood. When designing a visual, consider how it will be used. Will the presentation be with a large or small audience? Will projected, print or both presentation modes be necessary? What equipment will be available?

These are a few questions to consider when designing legible visuals. Too often graphs are designed as figures in some report, and later it is decided to make a transparency out of the same visual. The trouble is that as a transparency, it is illegible to 80% of the audience.

So, examine all possible modes of presentation and observe the following minimum standards of legibility for non-projected (charts) and projected materials.

Non-projected Materials

Maximum Viewing Distance (Feet)	Minimum Letter Height in (based on a lower-case m)
8	1/4"
12	1/2"
32	1"
64	2"

Projected Materials*

	Minimum Letter Height
Slides Transparencies Filmstrips	1/8"

*Maximum viewing distance in feet by multiplying 8 x the width of your projected image.

Part of designing legible visuals involves selecting lettering styles that are readable. A good clear blocked style is obviously more legible than exotic styles like Old English.

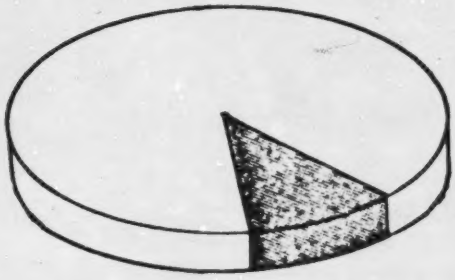
Symbolism

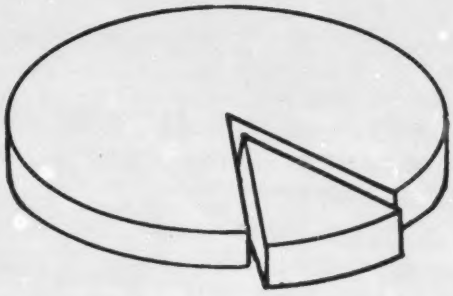
Frequently interest and meaning can be added to visuals by using symbols. If budgets are discussed, why not work some images of silver or dollar bills into the graph. If student achievement is shown, consider using stick figures of kids grouped together to reinforce the message.

Emphasis

There are many ways to place special emphasis on certain elements of the visual. Three methods to emphasize specific components involve using shading, separation and color. These techniques help focus the viewer's attention on the central message. Thus they can be used to simplify a complex visual.

For example, there may be a need to include a lot of secondary information in a single visual. The information is important, yet supplementary to the primary message. By properly using shading, separation from the whole, and/or color, audience attention can be directed to key components. Thus supplementary information stays in the background, supporting rather than interfering with the message.

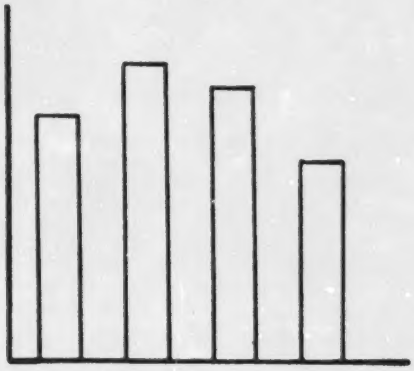




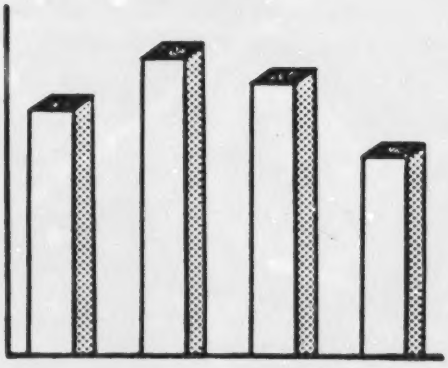
Interest

Too often graphs are static, dull and boring. Such visuals place mountains between an audience and the message. Audiences may turn off because attempting to decipher the message is not worth the effort -- the mountain is too high.

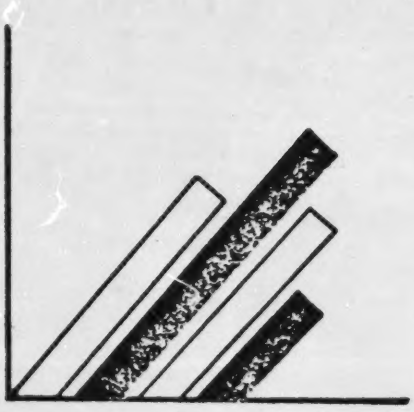
There are many ways to capture audience attention and promote interest in visuals. Take a simple bar graph, for example. The standard bar graph is less than inspiring. It incorporates simplicity, but to the point of monotony.



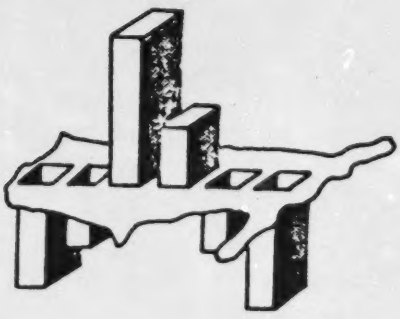
Why not add perspective to enliven it?



How about a radical angle to capture attention?



Or what if symbols are used to add interest to the message?

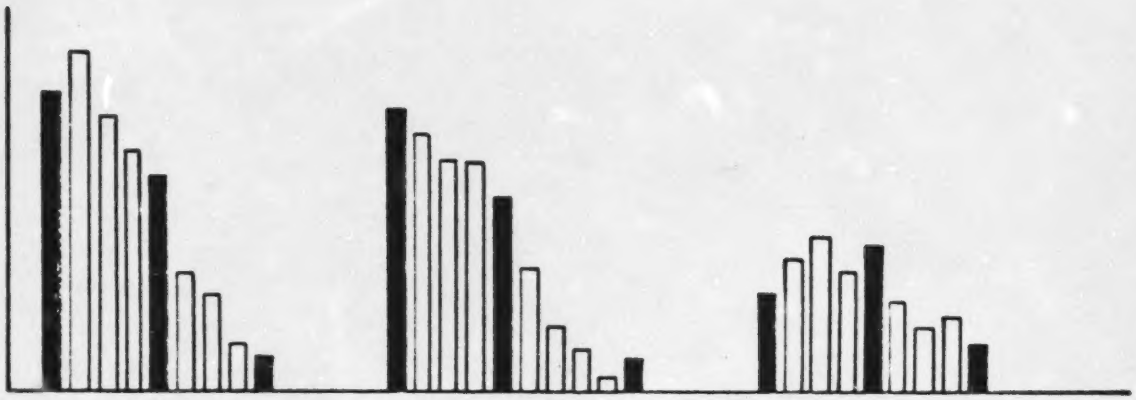


Whatever technique is used, the possibilities are endless and the audience will appreciate the ingenuity.

Comparison

When presenting a considerable amount of data, it is often necessary to direct audience attention to specific comparisons. The message can be passed over by wandering eyes if the graphic design hinders or fails to enhance important comparisons. Comparisons can be carried within and across visuals by using color, line, shading, etc.

For example, continuity can be carried across many different graphics by using color. Specific elements in each graph can be linked by standarizing the color used for each. The audience will correlate certain colors with specific variables (subject area, grade level, achievement levels, etc.) and can easily draw comparisons within and across variables.



None of these six considerations stand apart. They are interrelated and should be used in various degrees and combinations. Used effectively, they help stimulate audience interest and understanding. Thoughtful planning is vital. Know the audience, define purposes and design visuals that will help the communicatation. Remember to keep it simple.

BIBLIOGRAPHY

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1. Berdie, Douglas and John Anderson, Questionnaires: Design and Use Metuchen, N.J., The Scarecrow Press, 1974

2. Boehm, Ann E., The Classroom Observer: A Guide for Developing Observation Skills, New York: Teachers College Press

3. Cambell, Donald T. and Julia C. Stanley, Experimental and Quasi-Experimental Designs for Research, Chicago, Illinois: Rand McNally & Co., 1966

4. Cognetta, Randall, Statistics for the Building Administrator, Project Director, Teacher, Redwood City: San Mateo County Office of Education, 1976

5. Downie, N. M. and Robert W. Heath, Basic Statistical Methods, New York: Harper & Row Inc., 1974

6. Faddis, Bonnie, Displaying and Reporting Evaluation Data, Portland: Northwest Regional Educational Laboratory, 1981

7. Isaac, Stephen, and William B. Michael, Handbook in Research and Evaluation, San Diego: Robert R. Knapp, 1971

8. Ishikawa, Kaoru, Guide to Quality Control, Hong Kong: Nordica International Limited, 1980

9. Larrabee, Harold A., Reliable Knowledge, Boston: Houghton Mifflin Co. Co., 1964

10. Long, Susan and Randall Cognetta, Questionnaires Their Development and Use, Redwood City: San Mateo County Office of Education, 1978

11. Marascuilo, Leonard A., Statistical Methods for Behavioral Science, New York: McGraw-Hill Book Co., 1971

12. Shaw, M. E., and J. M. Wright, Scales for the Measurement Attitudes, New York: McGraw-Hill Book Co., 1967

13. Siegel, Sidney, Nonparametric Statistics, New York: McGraw-Hill Book Co., 1956

14. Simon, Anita and E. Gil Boyer, Mirrors for Behavior II, Wyncote, Pennsylvania: Communications Materials Center, 1974

15. Stephens, Kenneth S., Quality and Quality Control, New York: Unipub, 1981

16. Van Dalen, B. B., Understanding Educational Research, New York: Mc Graw-Hill Book Co., 1973

APPENDIX

DATA COLLECTION AND ANALYSIS

PRE/POSTTEST

1. Sketch the framework of a cause and effect diagram.

2. What is the purpose of a Cause and Effect Diagram?

3. List three reasons for using sampling techniques:

   a. _____

   b. _____

   c. _____

4. When sampling is used, How can "representativeness" be achieved?

5. Name three measures of central tendency:

   a. _____

   b. _____

   c. _____

6. How does a Pareto diagram differ from the usual bar graph?

7. Which element of the Pareto diagram is considered first by Circle members?

8. Name the four levels of data analysis in Quality Circles:

   a. _____

   b. _____

   c. _____

   d. _____

HILLSBOROUGH CITY SCHOOL DISTRICT

Several areas of interest have been identified in the questionnaire below. We would like to have an indication of your feelings about these areas and the importance you attach to them. In the center of the page is a series of statements. Please indicate your agreement or disagreement that each statement is true of Hillsborough schools now by marking the scale to the left. On the right of each statement, please indicate the importance you attach to it. Each statement shoul have two responses. Space has been provided for your comments and suggestions below each section.

1. If you have a child (children) attending Hillsborough public schools, please circle the grade(s).

K 1 2 3 4 5 6 7 8

2. Please check one or more of the categories below if it pertains to you:

____ Elementary Teacher
____ Middle School Teacher
____ Classified Employee
____ Student
____ Administrator
____ Resident without children in Hillsborough public schools

DO I AGREE OR DISAGREE WITH THIS STATEMENT							HOW IMPORTANT IS THIS AREA TO ME				
Strongly Agree	Agree	Disagree	Strongly Disagree	Lack Info to Respond		QUESTIONNAIRE ITEMS	Very Important	Important	Somewhat Important	Not Important	
						COMMUNICATION					
						1) The schools communicate clearly their rules and standards of behavior to parents.					
						2) The schools keep parents informed of school activities.					
						3) Students have the opportunity to communicate their interests and concerns to teachers.					
						4) The Board of Trustees is responsive to:					
						a) Parent concerns					
						b) Community needs					
						5) Students are kept informed of their progress by teachers.					
						6) Parents are encouraged to discuss their children's problems with teachers.					
						7) The following types of communication between home and school work well to keep parents informed about their children's progress:					
						a) Deficiency notices					
						b) Teacher notes and phone calls					
						c) Report cards					
						d) Parent-teacher conferences					
						8) The superintendent has effective means of hearing parents' concerns.					
						9) Individual test data (CTBS scores) and school records are made available in useful form to parents.					

Comments: _____

DO I AGREE OR DISAGREE WITH THIS STATEMENT						HOW IMPORTANT IS THIS AREA TO ME				
Strongly Agree	Agree	Disagree	Strongly Disagree	Lack Info to Respond	QUESTIONNAIRE ITEMS	Very Important	Important	Somewhat Important	Not Important	
					STUDENT BEHAVIOR					
					10) Students show respect for self and others.					
					11) Students show respect for school property.					
					12) Students behave in an acceptable manner in the classroom.					
					13) Parents are supportive of school standards for student behavior.					
					14) Discipline problems are being handled effectively by:					
					a) Teachers					
					b) Principals					
					15) Students dress suitably at school.					

Comments: _____

					CURRICULUM					
					16) The school district has a clearly stated curriculum.					
					17) The following curricular areas are meeting the students' needs:					
					a) Spelling					
					b) Grammar					
					c) Written Composition					
					d) Creative Writing					
					e) Reading					
					f) Social Studies					
					g) Science					
					h) Mathematics					
					i) Foreign Language					
					j) Physical Education					
					k) Music					
					l) Art					
					m) Library/Media Center					
					n) Technical Arts					
					o) Typing					
					p) Drama					
					q) Photography					
					r) Computer Science					

DO I AGREE OR DISAGREE WITH THIS STATEMENT						HOW IMPORTANT IS THIS AREA TO ME				
Strongly Agree	Agree	Disagree	Strongly Disagree	Lack Info to Respond	QUESTIONNAIRE ITEMS	Very Important	Important	Somewhat Important	Not Important	
					18) Students with special needs are receiving appropriate services in the following areas:					
					a) Health					
					b) Counseling					
					c) Learning Problems					
					d) Speech and Language					
					e) Gifted/Talented Education					
					f) Bilingual Education					
					19) Children have adequate equipment, materials and supplies available at school.					
					20) The schools should devote more time to cultural enrichment through:					
					a) Assemblies					
					b) Field Trips					
					21) Community volunteer services are being tapped sufficiently.					

Comments: _____

					TEACHERS AND INSTRUCTION					
					22) Homework assignments are meaningful.					
					23) The amount of homework is:					
					a) too much					
					b) too little					
					c) enough					
					24) Pupils are generally well taught in our schools.					
					25) Teachers are generally aware of social/emotional problems of students.					
					26) Teachers utilize a variety of methods to teach students.					
					27) Teachers should be given release time from instructional tasks to attend meetings/workshops designed to improve instruction.					
					28) Class size is:					
					a) too large					
					b) too small					
					c) about right					
					29) The district's yearly calendar meets the needs of the children, schools and community.					

DO I AGREE OR DISAGREE WITH THIS STATEMENT						HOW IMPORTANT IS THIS AREA TO ME				
Strongly Agree	Agree	Disagree	Strongly Disagree	Lack Info to Respond	QUESTIONNAIRE ITEMS	Very Important	Important	Somewhat Important	Not Important	
					30) The normal school day should: a) start earlier					
					b) end later					
					c) remain as it is					
					31) Basic skills instruction should be added to our present summer school program.					
					32) Parents hold student absence and tardiness to a minimum.					
					33) Classified personnel (secretaries, custodians, etc.) make a valuable contribution to the overall welfare of students.					
					34) The school district should offer the following services on a fee basis: a) Transportation					
					b) Summer school					
					c) Field trips					
					d) Instrumental music					
					e) Community use of school facilities					

Comments: _____

					BUILDING, GROUNDS AND TRANSPORTATION 35) Custodial service at the school sites is adequate.					
					36) The schools are well maintained with regard to: a) Buildings					
					b) Grounds					
					c) Equipment					
					37) The present bus service meets the needs of students.					

Comments: _____

LAGUNA SALADA UNION ELEMENTARY SCHOOL DISTRICT

CABRILLO SCHOOL

PEEP ASSESSMENT QUESTIONNAIRE

GENERAL INFORMATION:

- If you have a child(children) attending school, please circle the grade(s): ELEMENTARY K 1 2 3 4 5 6 7 8 HIGH SCHOOL 9 10 11 12

ITEM RESPONSE: (You are to respond TWICE to each item.)

- SECTION I — Place an "X" in the column which best expresses the degree of your agreement/disagreement with the statement as it relates to your school.
- SECTION II — Place an "X" in the column which best expresses your opinion of the importance of the activity for a child's education.

Also, space is provided for your comments/suggestions.

QUESTIONNAIRE ITEMS	SECTION I					SECTION II				COMMENTS/SUGGESTIONS (Please specify item number)
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	LACK INFO TO RESPOND	VERY IMPORTANT	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT	
CURRICULUM										
1. Students with special needs are receiving proper attention from special services personnel:										
a. Nurse										
b. Counselors										
c. Psychologists										
d. Speech teachers										
2. Cabrillo School is meeting the students' needs in the following curricular areas:										
a. Physical education										
b. Science										
c. Mathematics										
d. Social studies (history, geography)										
e. Language arts										
f. Reading										
g. Classroom music										
h. Instrumental music										
i. Electives										
j. Library										
3. There are adequate provisions for disruptive students in the classrooms.										
4. The number of textbooks and materials, per pupil, is sufficient.										
5. The present audio-visual materials (films, filmstrips, tapes, records, etc.) meet the needs of the school.										
6. The electives in grades 7 and 8 meet the students' needs and interest level.										
7. A sufficient number of assemblies and activities is provided.										
8. Eighth graders are academically prepared for high school										

CABRILLO SCHOOL

QUESTIONNAIRE ITEMS	SECTION I					SECTION II				COMMENTS/SUGGESTIONS (Please specify item number)
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	LACE INFO TO RESPOND	VERY IMPORTANT	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT	
9. Proficiency tests should be given by at least sixth grade										
10. Homework policies are consistent within the school program.										
11. Out of class activities, which reduce the classroom instructional time of students, are kept to a minimum. (music, cafeteria helpers, crossing guard helpers)										
BUILDING/MAINTENANCE										
12. The restroom facilities in the school are adequate.										
13. The condition of the playground is safe.										
14. The heating and ventilation systems in the school are adequate.										
15. The condition of classroom furniture and equipment is satisfactory.										
16. Classrooms are clean and well-maintained.										
17. The classroom facilities are suitable for 7th and 8th grade students.										
18. The grounds are suitable for 7th and 8th grade students.										
19. District Office maintenance services to Cabrillo School are satisfactory.										
20. Building repairs are handled adequately and quickly.										
CAFETERIA										
21. The cafeteria lunches are nutritionally well balanced.										
22. The cafeteria lunches are satisfactory in quantity.										
23. A snack bar would be an asset to the cafeteria program.										
FIELD TRIPS/TRANSPORTATION										
24. School bus transportation schedules meet the needs of students.										
25. Field trips expose students to community and cultural events.										
26. There is enough District funding for field trips.										
EQUIPMENT/SUPPLIES										
27. Supplies are readily available in sufficient quantities for classroom usage.										
28. Physical education equipment meets the needs of students.										
RECESS AND LUNCH ACTIVITIES										
29. Yard supervision is adequate.										
30. The school provides activities of interest to students during recess and lunch periods.										
VANDALISM										
31. Appropriate provisions are made to prevent/reduce vandalism.										

CABRILLO SCHOOL

QUESTIONNAIRE ITEMS	SECTION I					SECTION II				COMMENTS/SUGGESTIONS (Please specify item number)
	STRONGLY AGREE	AGREE	DISAGREE	STRONGLY DISAGREE	LACK INFO TO RESPOND	VERY IMPORTANT	IMPORTANT	SOMEWHAT IMPORTANT	NOT IMPORTANT	
COMMUNITY INVOLVEMENT/COMMUNICATION										
32. Parents are committed to the educational program of the school.										
33. Parent aides and volunteers are used appropriately in the classroom.										
PUPIL RESPONSIBILITY/DISCIPLINE										
34. Students respect the rights of others.										
35. The present school rules are effective.										
36. Students have too many restrictions placed on them in regard to their individual rights.										
TEACHERS AND INSTRUCTION										
37. The class size is:										
a. too large										
b. too small										
c. about right										
38. The teaching staff is performing effectively at Cabrillo.										
39. Teachers are consistently fair with students.										
40. Substitute teachers used at Cabrillo are performing effectively.										
41. The school day is:										
a. too long										
b. too short										
c. about right										

Please return the completed questionnaire to Cabrillo School, 601 Crespi Drive, Pacifica, CA 94044, by November 18, 1977.